American Machinist

ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC.

New York, May 7, 1931

SPUR GEAR TEETH

Their Strength and Durability

The nature and extent of actual working or dynamic loads on gear teeth or on any other operating elements of a mechanism have long been open questions. In the absence of evidence to the contrary, these dynamic loads have generally been considered as being directly proportional to the applied loads. This article which discloses a new conception of the problem will be presented as a paper before the Spring Meeting of the American Gear Manufacturers Association, May 7, Hotel Statler, Buffalo, N. Y.

EARLE BUCKINGHAM

Associate Professor,
Massachusetts Institute of Technology
Acting Chairman,
A. S. M. E. Special Research Committee on the Strength of Gears

VELOCITY factors have been established by running certain mechanical elements, such as ball-bearings or cast-iron gears, to destruction under varying speeds and loads. These applied loads, which caused failure, were then divided by the static load which would cause a similar failure, and the quotients thus obtained have been used as velocity factors. For example, if a pair of cast-iron gears, running at a certain pitch-line velocity, should fail under a transmitted load of 1,000 lb., and if these same gears would fail under a static load of 3,000 lb., the velocity factor for this speed would be taken as one-third. It is then assumed that under these same velocity conditions, the dynamic load would be equal to three times the applied load, so with an applied load of 250 lb., the dynamic load would be equal to 750 lb. In practice, this velocity factor has been used to reduce the safe working stress of the material by multiplying the safe static stress, which incudes a liberal factor of safety, by the velocity factor. For the determination of this velocity factor, the Barth equation $\left(\frac{600}{600+V}\right)$, or some modification of it, has been generally used.

Since 1923, a research committee, organized by the efforts of the late Wilfred Lewis, has been carrying on an investigation of this subject,—an investigation made possible by the co-operation of the A.G.M.A. and the A.S.M.E. From time to time, progress reports have been issued, but it was not until the spring of 1930 that the results of these tests and their analysis justified the formulation of a simple method of obtaining a reasonably close approximation to actual dynamic load conditions. A full report of the investigation of this committee to date is now in the hands of the printer and will be issued in the near future. The purpose of this article is to give a brief report of the findings and to present a simple method of approximating the intensity of the dynamic loads on spur gear teeth.

The analysis of dynamic loads, which is primarily the result of suggestions from Carl G. Barth, has been applied successfully to the results of three distinct and independent types of tests: first, the separation of the tooth surfaces as indicated by a break in the electric circuit between the teeth; second, surface fatigue tests where the failure of the tooth surface was taken as a measure of commensurate loads, as these loads also set up compressive stresses approximately equal to the ultimate compressive strength of the material; and third, actual breaking tests on cast-iron and semi-steel gears. The extent of the errors on the gears tested ranged from 0.0005 inch to 0.0060 inch, and except for the breaking tests, a wide variety of materials was tested. The computed results from this analysis, considering the nature and extent of the many uncertain factors such as the structure of the material and the many observational errors, are remarkably consistent—generally within 25 per cent of each other. It would appear from this evidence that the proposed method of determining dynamic loads on spur gear teeth can be safely employed and will give a far closer measure of the truth than any of the present methods.

Errors on gear tooth profiles, together with their deformation under load, cause the masses on the driving

and driven shafts to change their velocities slightly. This change in velocity and momentum tends to cause the tooth surfaces to separate although resisted by the applied load. After separation, the surfaces of the teeth come together again with an impact. The additional or increment load set up by this impact depends primarily upon the amount of change of momentum in the revolving masses caused by the effective errors in the gear tooth profiles. On metal gears, where the effective error is primarily the initial error in the gear tooth profiles and the deformation under load is but a small part of the effective error, this increment load will not be directly proportional to the applied load but will be almost independent of it. On non-metallic gears, on the other hand, where the largest part of the effective error is the deformation under load, this increment load may be very nearly directly proportional to the applied load.

Table I—Values of *C*

Materials	Tooth Form	Measured Error in Inches 0.0005	0.001	0.002	0.003
Cast iron and cast iron	14½° inv.	400	800	1,600	2,400
Cast iron and cast iron	20° full depth	415	830	1,660	2,490
Cast iron and cast iron	20° stub	430	860	1,720	2,580
Cast iron and steel...	14½° inv.	550	1,100	2,200	3,300
Cast iron and steel...	20° full depth	570	1,140	2,280	3,420
Cast iron and steel...	20° stub	590	1,180	2,360	3,540
Steel and steel.....	14½° inv.	800	1,600	3,200	4,800
Steel and steel.....	20° full depth	830	1,660	3,320	4,980
Steel and steel.....	20° stub	860	1,720	3,440	5,160

To sum up: The maximum dynamic loads on moving parts of a mechanism are impact loads, their intensity being the sum of the transmitted load and an increment load. This increment load is very nearly a constant with metal parts for any given speed on any given mechanism. It is only when non-metallic parts with a very low modulus of elasticity are involved that the increment loads approach the condition where they are practically directly proportional to the applied loads. The stresses set up by these impacts must not exceed the compressive fatigue limits of the materials employed if excessive wear is to be avoided. For metal parts, where the increment load is practically independent of the intensity of the applied load, a margin of safety would appear to be a more logical value to use than a factor of safety. Dynamic loads on metal parts are not directly proportional to the applied loads; hence the use of velocity factors in such cases is not only incorrect but also misleading.

The various equations required for a complete and detailed analysis of the dynamic load phenomena are complex and require the use of values for many factors. For general use, it is often desirable to have simple equations which will give a reasonably close approximation to the actual load conditions. It should be fully appreciated, however, that such a formula can cover only the normal or average conditions. As with all other engineering standards and approximate equations, exceptional conditions should receive special consideration. Thus for example, where gears are to be used for an aeroplane propeller drive and the weights of the gear blanks have been reduced to a minimum, the mass conditions here will be much below the average and the use of these general equations may give increment load values somewhat larger than the actual ones. On the other hand, if the gear is very large and the gear blank is also to act as a flywheel, the mass conditions may be very much greater than the average, and the use of these general equations may give increment load values somewhat smaller than actual.

As noted before, the maximum dynamic load on gear teeth is the sum of the applied load and an additional or increment load resulting from the inertia of the masses and the variations in velocity set up by the action of the effective errors in the gear teeth. This maximum load is but momentary, yet the teeth must be strong enough to carry it.

The following equations apply to metal spur gears:

W = Total tooth load transmitted in lbs.
T = Width of gear face in inches
f = Applied load in lbs. per inch of face
V = Pitch line velocity in ft. per min.
I = Increment load in lbs. per inch of face
f_2 = Load in lbs. per inch of face required to deform teeth the amount of the effective error
C = Tabulated value representing the load required to deform a tooth of given material and form a given amount
W_d = Total maximum dynamic tooth loads in lbs.

Then:

$$f_2 = f + C \tag{1}$$

$$f = \frac{W}{T} \tag{2}$$

$$I = \frac{0.05\, V\, f_2}{0.05\, V + \sqrt{f_2}} \tag{3}$$

$$W_d = T\,(f + I) \tag{4}$$

The value of C will be directly proportional to the

Table II—Values of *I*

For values of f_2 from 500 to 6,000

V	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000
100	91	137	172	201	227	251	273	293	312	330	347	364
200	155	240	308	365	417	463	506	546	584	619	653	686
300	201	322	419	502	577	645	708	767	822	875	925	973
400	236	387	511	618	714	802	884	961	1,034	1,102	1,168	1,231
500	264	442	588	717	833	940	1,040	1,133	1,222	1,306	1,386	1,464
600	286	487	655	803	938	1,062	1,178	1,287	1,391	1,489	1,584	1,675
800	321	558	762	944	1,111	1,266	1,412	1,550	1,669	1,806	1,927	2,043
1,000	346	613	845	1,056	1,250	1,432	1,603	1,766	1,922	2,071	2,215	2,354
1,200	364	655	912	1,146	1,364	1,568	1,765	1,947	2,125	2,295	2,460	2,619
1,400	379	689	966	1,220	1,458	1,683	1,897	2,101	2,298	2,487	2,671	2,848
1,600	391	717	1,010	1,283	1,538	1,781	2,012	2,234	2,448	2,654	2,854	3,048
2,000	409	760	1,081	1,382	1,667	1,938	2,199	2,450	2,759	2,929	3,158	3,381
2,500	424	798	1,145	1,473	1,786	2,086	2,376	2,656	2,928	3,193	3,452	3,704
3,000	435	826	1,192	1,541	1,875	2,198	2,510	2,813	3,109	3,398	3,680	3,957
3,500	443	847	1,228	1,593	1,944	2,285	2,616	2,938	3,253	3,561	3,863	4,159
4,000	450	863	1,257	1,635	2,000	2,355	2,701	3,039	3,370	3,694	4,012	4,325
4,500	455	877	1,280	1,668	2,045	2,413	2,771	3,122	3,466	3,804	4,136	4,463
5,000	459	888	1,299	1,697	2,083	2,461	2,830	3,192	3,548	3,898	4,242	4,581

Table III—Values of *Ws*
for 14½° tooth form, 1 DP, 1-in. face

Number of Teeth	Cast Iron	Semi-steel and Bronze	Cast Steel	SAE 1030 Steel	SAE 1045 Steel	SAE 3245 Steel
	Values of *S*					
	24,000	36,000	45,000	60,000	90,000	120,000
12	5,160	7,740	9,675	12,900	19,350	25,800
13	5,354	8,031	10,040	13,386	20,079	26,772
14	5,654	8,482	10,602	14,136	21,204	28,272
15	5,880	8,820	11,025	14,700	22,050	29,400
16	6,108	9,162	11,452	15,270	22,905	30,540
17	6,333	9,500	11,875	15,834	23,751	31,668
18	6,484	9,727	12,159	16,212	24,318	32,424
19	6,636	9,954	12,442	16,590	24,885	33,180
20	6,784	10,177	12,721	16,962	25,443	33,924
21	6,936	10,404	13,005	17,340	26,010	34,680
23	7,087	10,630	13,288	17,718	26,577	35,436
25	7,312	10,969	13,711	18,282	27,423	36,564
27	7,464	11,196	13,995	18,660	27,990	37,320
30	7,615	11,422	14,278	19,038	28,557	38,076
34	7,840	11,761	14,701	19,602	29,403	39,204
38	7,992	11,988	14,985	19,980	29,970	39,960
43	8,143	12,214	15,268	20,358	30,537	40,716
50	8,294	12,441	15,552	20,736	31,104	41,472
60	8,520	12,780	15,975	21,300	31,950	42,600
75	8,671	13,006	16,258	21,678	32,517	43,356
100	8,822	13,233	16,542	22,056	33,084	44,112
150	8,973	13,464	16,825	22,434	33,651	44,868
300	9,199	13,798	17,248	22,998	34,497	45,996
Rack	9,350	14,025	17,532	23,376	35,064	46,752

extent of the error. As the modulus of elasticity of cast iron and bronze are nearly alike, the values of *C* given in Table 1 for cast iron can also be used for bronze.

To simplify the use of this material still further, Table 2 was prepared which gives the value of *I* for pitch line velocities up to 5,000 ft. per min. corresponding to values of f_2 up to 6,000 lbs. Thus for any given combination of materials with any known error, the value of f_2 is determined by adding the corresponding value of *C* from Table 1 to the amount of the transmitted load per inch of face. Then the value of *I* for the specified pitch line velocity may be taken from Table 2 from the column headed by the predetermined value of f_2.

The foregoing equations and tables will give a close approximation to the intensity of the maximum instantaneous dynamic load. We must next have some measure of the beam strength of the gear teeth to insure that they will be strong enough to withstand this dynamic load without breaking. For this purpose we have the Lewis formula which is as follows:

When:

W_s = Limiting static tooth load for beam strengths in lbs.
S = Elastic limit of material in lbs. per sq.in.
P = Circular pitch of teeth in inches
T = Width of face of gear in inches
y = Tooth form factor

Then: $$W_s = SpTy \qquad (5)$$

To simplify the use of this material on static beam strength, Tables 3, 4, and 5 were prepared, which give the static beam strength of 1 DP gears of one-inch face for the three most commonly used gear-tooth systems. The values in these tables should be divided by the diametral pitch and multiplied by the width of face in inches of the gear blanks.

We must also have some measure of the durability of the surfaces of the gear teeth to avoid excessive wear. For this purpose, we can use the following equations and values:

When:

W_w = Limiting static tooth load for wear in lbs.
D = Pitch diameter of pinions in inches
T = Width of face in inches
Q = Ratio factor
K = Load-stress factor
n = Number of teeth in pinion
N = Number of teeth in gear
E_1 & E_2 = Modulus of elasticity of materials
S_f = Compressive fatigue limit stress for material in lbs. per sq.in.
A = Pressure angle of tooth form.

Then:

$$Q = \frac{2N}{n+N} \qquad (6)$$

$$K = \frac{S_f^2 \sin A}{1.400}\left(\frac{1}{E_1}+\frac{1}{E_2}\right) \qquad (7)$$

$$W_w = D\,T\,K\,Q \qquad (8)$$

To simplify the use of this material, Table 6 was prepared, which gives values for *K*, corresponding to the probable fatigue limit stress for the materials. For the sake of simplicity, a pressure angle of 14½ deg. was employed in computing these tabulated values. These figures represent the limiting load conditions and make allowance for the cold-working received in operation. The dynamic loads should be such that somewhat lower values are used, depending upon the margin of safety required for any specific application. These figures are also based upon smooth tooth surfaces.

As an example of the use of this material, consider the following:

A pair of 8 DP gears, 14½ deg. tooth form, of 33 and 59 teeth, 1.250 inches width of face were used in a machine, running at a pitch line velocity of about 300 ft. per min. and transmitting a tooth load of about 400 lbs. Originally these gears were of semi-steel and had operated satisfactorily for several years. Recently they

Table IV—Values of *Ws*
for 20° full-depth tooth form, 1 DP, 1-in. face

Number of Teeth	Cast Iron	Semi-steel and Bronze	Cast Steel	SAE 1030 Steel	SAE 1045 Steel	SAE 3245 Steel
	Values of *S*					
	24,000	36,000	45,000	60,000	90,000	120,000
12	5,880	8,820	11,025	14,700	22,050	29,400
13	6,259	9,388	11,736	15,648	23,472	31,296
14	6,636	9,954	12,442	16,590	24,885	33,180
15	6,936	10,404	13,005	17,340	26,010	34,680
16	7,087	10,630	13,288	17,718	26,577	35,436
17	7,238	10,857	13,572	18,096	27,144	36,192
18	7,389	11,084	13,855	18,474	27,711	36,948
19	7,540	11,311	14,139	18,852	28,278	37,704
20	7,689	11,534	14,418	19,224	28,836	38,448
21	7,840	11,761	14,701	19,602	29,403	39,204
23	7,992	11,988	14,985	19,980	29,970	39,960
25	8,143	12,214	15,268	20,358	30,537	40,716
27	8,368	12,553	15,691	20,922	31,383	41,844
30	8,594	12,891	16,114	21,486	32,229	42,972
34	8,896	13,345	16,681	22,242	33,363	44,484
38	9,199	13,798	17,248	22,998	34,497	45,996
43	9,499	14,248	17,811	23,748	35,622	47,496
50	9,801	14,702	18,378	24,504	36,756	49,008
60	10,104	15,156	18,945	25,260	37,890	50,520
75	10,404	15,606	19,507	26,010	39,015	52,020
100	10,706	16,059	20,074	26,766	40,149	53,532
150	11,008	16,513	20,641	27,522	41,283	55,044
300	11,308	16,963	21,204	28,272	42,408	56,544
Rack	11,611	17,416	21,771	29,028	43,542	58,056

were replaced with machine-steel gears, the material being about the same as SAE 1045 steel, and in about eight weeks they had worn so badly as to be practically worthless.

The extent of the error to be expected on well-cut gears of this size is about 0.002 inch. Using this value as a measure of their accuracy, we have the following for the original semi-steel gears:

$$f = \frac{400}{1.25} = 320 \quad \text{(Equation 2.)}$$

$$V = 300$$

$$T = 1.25$$

From Table 1, we obtain

$$C = 1.600$$

$$f_2 = 320 + 1.600 = 1920 \quad \text{(Equation 1.)}$$

Table V—Values of *Ws* for 20° stub tooth form, 1 DP, 1-in. face

Number of Teeth	Cast Iron	Semi-steel and Bronze	Cast Steel	SAE 1030 Steel	SAE 1045 Steel	SAE 3245 Steel
	Values of *S*					
	24,000	36,000	45,000	60,000	90,000	120,000
12	7,464	11,196	13,995	18,660	27,990	37,320
13	7,766	11,649	14,562	19,416	29,124	38,832
14	8,143	12,214	15,268	20,358	30,537	40,716
15	8,368	12,553	15,691	20,922	31,386	41,844
16	8,671	13,006	16,258	21,678	32,517	43,356
17	8,822	13,233	16,542	22,056	33,084	44,112
18	9,048	13,572	16,965	22,620	33,930	45,240
19	9,275	13,910	17,388	23,184	34,776	46,368
20	9,424	14,137	17,671	23,562	35,343	47,124
21	9,576	14,364	17,955	23,940	35,910	47,880
23	9,801	14,702	18,378	24,504	36,756	49,008
25	10,027	15,040	18,801	25,068	37,602	50,136
27	10,255	15,382	19,228	25,638	38,457	51,276
30	10,480	15,721	19,651	26,202	39,303	52,404
34	10,706	16,059	20,074	26,766	40,149	53,532
38	10,932	16,398	20,497	27,330	40,995	54,660
43	11,083	16,624	20,781	27,708	41,562	55,416
50	11,385	17,078	21,348	28,464	42 696	56,928
60	11,611	17,416	21,771	29,028	43,542	58,056
75	11,913	17,870	22,338	29,784	44,676	59,568
100	12,139	18,208	22,761	30,348	45,522	60,696
150	12,441	18,662	23,328	31,104	46,656	62,208
300	12,818	19,227	24,034	32,046	48,069	64,092
Rack	13,193	19,792	24,741	32,988	49,482	65,976

Table VI—Values of *K*

Materials	Assumed fatigue limit in compression lbs. per square in.	Maximum specific compressive stress	*K*
Cast steel and cast steel	60,000 60,000	60,000	43
Forged steel and cast steel	80,000 60,000	65,000	50
Forged steel and forged steel	80,000 80,000	80,000	76
Hardened steel and cast steel	220,000 60,000	90,000	96
Forged steel and semi-steel	80,000 90,000	80,000	114
Hardened steel and phosphor bronze	220,000 70,000	85,000	135
Hardened steel and semi-steel	220,000 90,000	90,000	145
Heat-treated steel and heat-treated steel	120,000 120,000	120,000	171
Semi-steel and semi-steel	90,000 90,000	90,000	193
Hardened steel and heat-treated steel	220,000 120,000	130,000	201
Hardened steel and hardened steel	220,000 220,000	220,000	576

From Table 2, we obtain:

$$I = 500$$

$$W_d = 1.25\ (320 + 500) = 1{,}025 \text{ lbs.} \quad \text{(Equation 4.)}$$

From Table 3, we have for the static beam strength of the 33 tooth, 8 DP semi-steel pinion:

$$W_s = \frac{11.700 \times 1.25}{8} = 1{,}828 \text{ lbs.}$$

Here we have a margin of safety of 800 lbs. which is double the applied load. The factor of safety would be equal to 1.78 which seems low according to our usual ideas, yet it has proved to be ample in this case.

We will next examine the wear conditions on this drive. For the solution of Equations 6 and 8 we have:

$$D = 4.125$$

$$T = 1.250$$

$$n = 33$$

$$N = 59$$

$$Q = \frac{118}{92} = 1.282 \quad \text{(Equation 6.)}$$

From Table 6 we obtain:

$$K = 193$$

$$W_w = 4.125 \times 1.25 \times 1.282 \times 193 = 1{,}276. \quad \text{(Equation 8.)}$$

This last value which represents the limiting load for wear is about 250 lbs. greater than the dynamic load. In other words, we have a margin of safety of 250 lbs. which seems somewhat small, yet it has proved to be sufficient in service.

We will next compute in a similar manner the dynamic load conditions on the machine-steel gears. For these we have:

$$f = 320$$

$$V = 300$$

$$T = 1.25$$

From Table 1, we obtain:

$$C = 3{,}200$$

whence:

$$f_2 = 320 + 3{,}200 = 3{,}520 \quad \text{(Equation 1.)}$$

From Table 2, we obtain:

$$I = 710$$

$$W_d = 1.25\ (320 + 710) = 1{,}288 \text{ lbs.} \quad \text{(Equation 4.)}$$

From Table 3, we have for the static beam strength of the 33 tooth, 8 DP pinion:

$$W_s = \frac{29{,}100 \times 1.25}{8} = 4{,}547 \text{ lbs.}$$

Here we have, for beam strength, a margin of safety of about 3,250 lbs., and a factory of safety of 3.53. But the trouble here is excessive wear and not the breaking of the tooth.

For the wear load conditions we have:

$$D = 4.125$$

$$T = 1.250$$

$$Q = 1.282$$

And from Equation 7 using a value of S_f equal to 90,000 lbs. per sq.in.:

$$K = 96$$

Whence from Equation 8:

$$W_w = 635 \text{ lbs.}$$

In this case, the dynamic load is more than double the limiting load for wear, hence the rapid wear which took place is something to be expected. This example from actual experience makes still another check on the general validity of the proposed method of computing dynamic loads and the ability of gears to withstand them.

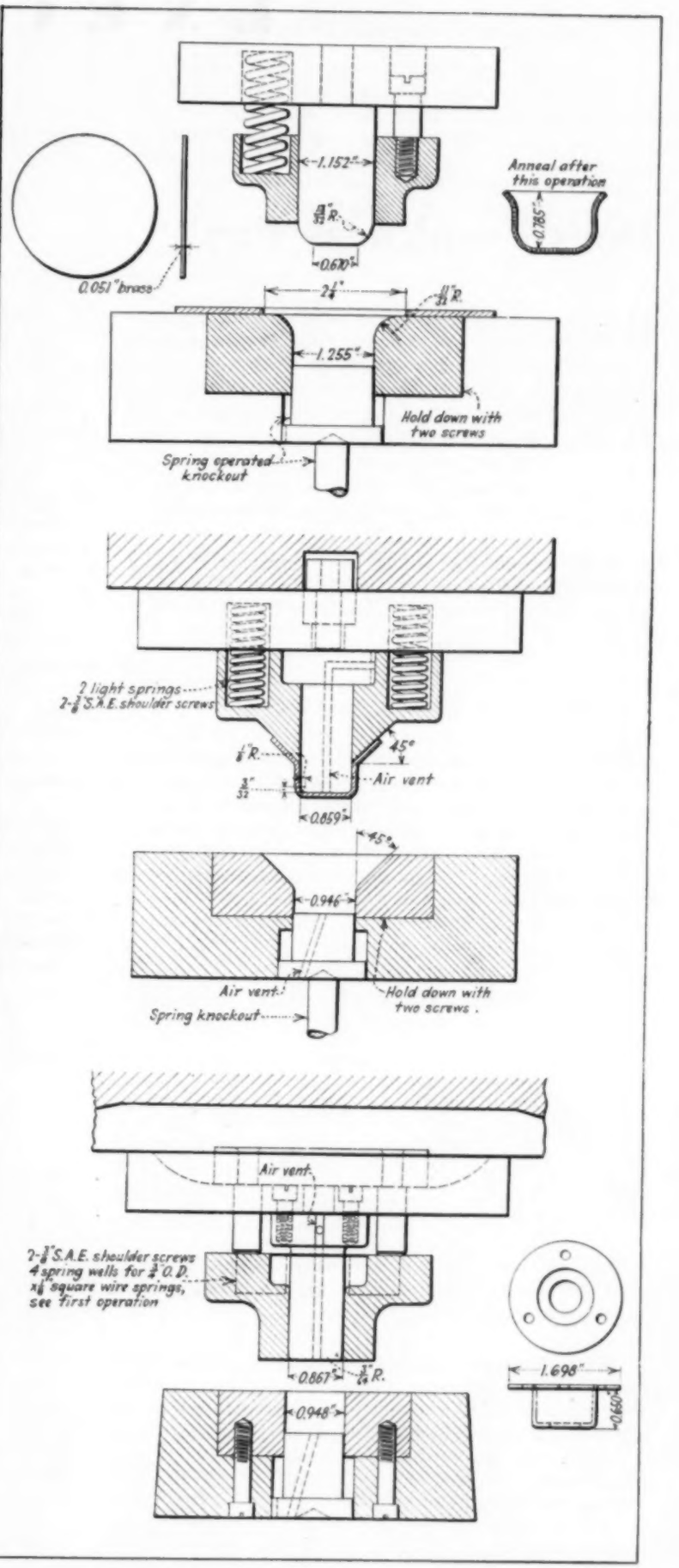
ACCURATE WIDE-FLANGED SHELLS

WILLIAM C. BETZ
Master Mechanic,
Fafnir Bearing Company

IT IS POSSIBLE to blank and partially draw a cup at one stroke, either in a single or double acting press, and thus leave a broad flange; but where this method is used, the pressure necessary to iron the blank out and prevent wrinkles makes the cup of one thickness near the bottom and another thickness near the top. The cups described here not only have a wide flange in proportion to the size of the cup, but the outside and inside surfaces of the cup must be made to exact diameters. The outside must fit a specified bore, and the inside must be made so that a standard diameter ball bearing will be a push fit in it. It will also be noted that there is very little radius at the junction of the body of the cup and the flange.

In working out the forming dies it will be observed that, in the finish die, the punch does the work ordinarily done by the die in that the stock is being ironed down by the punch. In this die the ironing from the inside carries the metal down ahead of the punch and fills the die clear to the bottom; this makes the cup's walls parallel and keeps the outside of the cup smooth. This method also prevents the punch from pushing the bottom out of the cup, because the cup is set into the die. The punch forces itself down into the cup, and the stripper flattens the flange at the same time.

This process has been employed only when working soft metals such as brass, bronze, aluminum, and the non-ferrous metals, but it might be employed on steel with slight changes and annealing of the blanks after each operation.



EXECUTIVE FORUM

Does Frankness Pay?

BILL HOLLAND had little patience with the time-honored custom of keeping callers waiting in an anteroom. Busy or not, he always made time to see an old friend. So when his secretary announced Frank Craig, Works Manager of the Channing Metal Works, the visitor was summoned at once.

"Glad to see you," said Bill in response to Craig's greeting. "How is everything going at the plant?"

"Well enough, everything considered," said Craig. "The company has its ups and downs but manages to get its share of business. The chief trouble seems to be with me."

"You look as though you could stow away three meals a day without any difficulty," said Bill.

"My appetite's all right," said Craig, "but I seem to be fed up with my present job. For the past six months, I've felt restless. First I tried to shake it off by working twice as hard and then by taking a few days' vacation. But the feeling seems to get worse instead of better. I've concluded that a change of jobs is the only answer."

"Go easy on that," said Bill. "This is a poor time to make a change. Good jobs don't grow on trees any more. Why not take a real rest, say for a couple of weeks? You might come back with an entirely new slant on life."

Craig shook his head. "I'm afraid it would be no use. The basic trouble is a conviction that I'm in a dead-end job. I imagine a good many men would think my attitude foolish and be content to let well enough alone. But I simply can't keep up my interest unless I see something ahead."

"If that's the way you feel, why not put it up to your president?" said Bill. "Mr. Wharton would probably see your point of view."

"That's just the trouble," said Craig. "I've been associated with Wharton a good many years and know the way his mind works. Individuals are either all right or all wrong to him. If I told him the things I've just told you, he'd think it little short of treason. He'd simply conclude I'd gone sour on the job and replace me without delay. I'm not ready for that."

"What did you have in mind?" asked Bill.

"Suppose I made an active effort to secure a new connection. Wouldn't it be ample time to talk to Wharton after my plans were all arranged? I'd give him sufficient time to fill my job, of course. But I question the wisdom of telling him how I feel until my prospects had pretty well materialized."

"And then suppose Wharton found out what you were up to," said Bill. "Taking your own opinion of him, he'd think your plans were not strictly above board and with some justice. That would place you in an embarrassing position."

"That's a chance I'd have to take," said Craig. "In my own mind, I'm convinced that such a course would involve nothing improper or disloyal. If Wharton were dissatisfied with my work and wanted a new man, he'd certainly select that man before I received my notice. From my observation, much of this loyalty to corporations works only one way. The individual must safeguard his own interests first."

"I can't agree with you," said Bill. "Go to Wharton and explain that in fairness to the company and yourself, you feel it would be better to seek a new connection. He'd probably try to induce you to stay. But when he saw you were set on making a change, he'd undoubtedly give you an opportunity to formulate your new plans."

"Too much opportunity, perhaps," said Craig.

■

What Do You Think About This Problem?

When a man, holding a responsible position, becomes dissatisfied and wishes to make a change, what should his course of action be? Should he explain his feelings to his employer or make his own plans first? Is it unethical to seek a new connection while still holding the old position? Is the company likely to appreciate frankness on the part of the employee? Or is such a course likely to react against him?

. . . Discussion

of Executive Problems

■

Inducing Ideas

Some type of incentive system is theoretically desirable for design departments. However, many years' experience in the administration of such a department only strengthens my conviction that incentives cannot be awarded on any mathematical basis. There are so many factors entering into any scheme of evaluation that it is impossible to write them into an equation. The work of any designer over a period of time involves so many crests and troughs in his personal accomplishment, that any scheme would have to provide for his failures as well as his successes. The failure of most incentive systems lies in that the proof of a good design occurs long after it is actually completed, and that the form of bonus must be based on a few factors only. The shrewd man, not necessarily the best, emphasizes the factors of the scheme that profit him most, often to the detriment of other desirable factors not so included.

There is, however, one form of bonus scheme that can't be beat, and that is the good old-fashioned "raise." Particularly at a time like this, when engineering departments are truly pressed, a raise is a wonderful stimulus. This form of bonus can be administered with true freedom and justice, considering all factors over a period of time, and is not restricted to brilliant bursts of activity. Men who fall off in their utility and production can be warned, and if necessary, have their salaries reduced

—JOHN F. HARDECKER, *Chief Draftsman, Naval Aircraft Factory.*

Filling the Gaps

Making mechanical parts when you have excess shop capacity is a sound business proposition if the labor and material cost is the same or a little under the purchase price of the article. Most plants have lathe and screw machine equipment that is standing idle during this slack period. They could be put to work making short runs of parts that are now being bought outside. This equipment should also be used to make up machine repairs, so that when the plant gets back to normal, there will be no delay in waiting for the part to be shipped from the machine builder when a breakdown occurs. Making these parts during slack periods will add very little to the overhead which is more than offset by keeping the working force intact. Temporary departures from standard accounting practice are warranted to meet unusual conditions.

—L. G. PATTERSON, *Factory Superintendent, Armstrong Machine Works.*

Convenience or Confusion?

In speaking of our intricate measuring system, we often refer to it as the English measurement. We would be nearer the mark if we spoke of it as the old English measurement. There are very few shops in England where this method is used today. Some of the largest and most important firms there, use the metric system entirely and micrometers, verniers, height gages, and other measuring instruments are provided accordingly. For the benefit of those preferring to use their own one inch micrometers, a conversion table is given to each man. In shops where the inch measurements are still used, the dimensions are always given in decimals or in tenths and hundredths.

The favorite scale of the English mechanic of today has metric on one side and on the reverse tenths and hundredths of an inch at the bottom and sixty-fourths at the top. Those belonging to combination squares are usually 300 millimeters long, or 0.001 short of $11\frac{13}{16}$ in. At first, these scales would be very confusing to an American machinist, who would confuse them with a 12-in. scale.

We all agree that our nation's decimal money system is far in advance of the confusing pounds, shillings, and pence of Colonial days. It is therefore only logic then if one decimal system is good for the country, the metric system should be adopted in all our various measurements.

—ALFRED LAYZELL.

The precision with which American machines are made, the quality of their output, and the factors introduced for the purpose of speeding up production are outstanding features that have made it possible to introduce them into foreign countries. That this introduction has been carried on despite "the terrible handicap of the English system of measurements" is a complete and satisfactory rebuttal to any argument that can be advanced in favor of the metric system. The energy of manufacturers in building up, maintaining, and satisfying our foreign trade would indicate that the adaptability of a machine lies in its worth as a working tool rather than in the system of measurements used in its construction.

If we grant all of the advantages claimed for the metric system, why have not the American manufacturers voluntarily adopted it long before this? It is a legal basis of measurement in the United States and is commonly used in a number of our present activities so it is not "a stranger within our gates." Is it that "the vociferous minority," having been unable to force its private opinions upon the public, are now attempting to do through legislation what they have been unable to do by reason? To pass a law forcing the manufacturer into a situation not of his own choosing would only result in evasion, confusion, and resentment.

—R. B. SMITH, *Principal, School of Mechanical Engineering, International Correspondence School.*

Come Seven?

The idea that the country can produce more than it can consume is one of the strangest beliefs of modern times. The trouble is with the distribution of purchasing power. The goods that stand unsold on the store shelves are the very things that the passers-by would like to pur-

chase if they had either money or credit to do it. How can anyone say that they should work less and earn less so as to give them leisure to enjoy the things they cannot buy?

If working hours were reduced to seven or to six, in normal times as well as in depressions, less would be produced, but there is no reason to think that the distribution would be any better. Shortening the working hours will have no effect on the maladjustments of money or of men, nor would it reduce the amount of unemployment. But it would lower the standard of living and leave a smaller margin to relieve distress in times of depression. —A. W. FORBES, *Forbes & Myers.*

Misguided Loyalty?

The president, sensing something amiss with the works manager, should have obtained his information concerning the cause from an outside source, rather than ask a subordinate to divulge information which had been given to him in confidence. Therefore, the assistant was justified in declining to give the president the information requested, because it was his superior's private affair.

Refusal in this case does not constitute disloyalty to the firm, and upon second thought the president will admire the assistant for the stand he has taken. To betray a friend's confidence for possible personal gain would brand the man as undesirable in any organization. Even though his fellow workers might be unaware of the state of affairs, his own conscience would point the finger of scorn, and he would know himself to be a cad.

—A. TOMLINSON.

Being asked to furnish an opinion on superiors creates a delicate situation. From an idealistic standpoint one is justified in refusing to do so. Ideals are not usually or readily appreciated, and a statement in this form might react against him as indicating an attempt to conceal the facts. Martyrs to ideals do not get a deal of sympathy.

His loyalty, from a practical standpoint, is to his bread and butter, but if he can tell the truth and help his superior and the company to get both straightened out, he is lucky. —JOHN S. ISDALE, *Plant Engineer, International Silver Company.*

Promising Performance

Two years ago, I attended an exhibition of machinery and bought four machines with a new type clutch. The first arrived one month later. In less than a week it started giving trouble, and later the whole lot proved bad. We had the manager down from the makers, and he had one machine sent back to his works. The trouble still remained, and we had to alter all four before we could get decent results. Our own engineering department did this. We found later that the machine we saw at the exhibition was the first made and had never been run under working conditions. We had to pay in lost time and work, while if there had been a performance guarantee, the firm would not have dared to sell without making some practical tests, both in their own interests and those of their customers. —T. SMITH, *Sutton-in-Ashfield, England.*

One of the difficulties of guaranteeing performance lies in precisely specifying the conditions under which the seller is to be placed for the preparation of the guarantee. Many machine tool firms have prepared forms which when properly filled in by the salesman on the ground provide most of the information required. This, with a covering report from the salesman together with blueprints and samples, should enable a fairly close estimate of the production times to be prepared.

The advantages of guarantees are many. The circumstances necessitate the buyer and seller getting into closer contact. From this, we may expect a more rapid development in the design of machine tools and equipment. Plant obsolescence is more readily exposed, and observant salesmen are provided with more forcible arguments for selling. Selling production instead of machine tools lessens the importance of the comparative price factor which often puts the seller of high priced equipment at a disadvanrtage. —J. D. SCAIFE, *Leamington Spa, England.*

Brain Fag

A brain or a body which cannot stand up under present-day short thinking or working hours is either lazy or not fitted for the type of vocation into which it has been hired. One with a prima donna temperament should never have been trained for the metal-working industries. We have use for only the hard steady worker, whether he does physical or mental work. Every company is trying to keep the shop temperature and lighting conditions as comfortable as possible. Anybody who is uncomfortable has usually only himself to blame.

The answer to so-called brain fag in designing is to have more than one problem. When the brain balks on the design of a side grinding machine, I turn to a yarn drying device, a precision measuring machine, or one of several designing problems we continually have ahead of us. A change of thought is more restful and pays better returns than a walk and a smoke.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

Food for Thought

It has been proven that a lunchroom cannot ordinarily be run on a paying basis or even a break even when everything is accurately accounted for. Many things enter into the question of the desirability of having one in a plant. The location of the plant in regard to outside lunchrooms, the size of the plant, and the time allowed for luncheon must be considered.

A firm should know the cost so it may determine whether or not the lunchroom is worth-while. There is no logical reason why a report on this department should not show its actual cost. Most people will agree that there are some things in favor of a lunchroom and that some outlay for it is justified by the practical results that can reasonably be expected. —JOHN MARK MAY.

Commencing with this issue the Foreman's Round Table and the Executive Forum will be published alternately week by week. This practice will follow the expressed wishes of the vast majority of our readers as recorded in the recent mail vote.

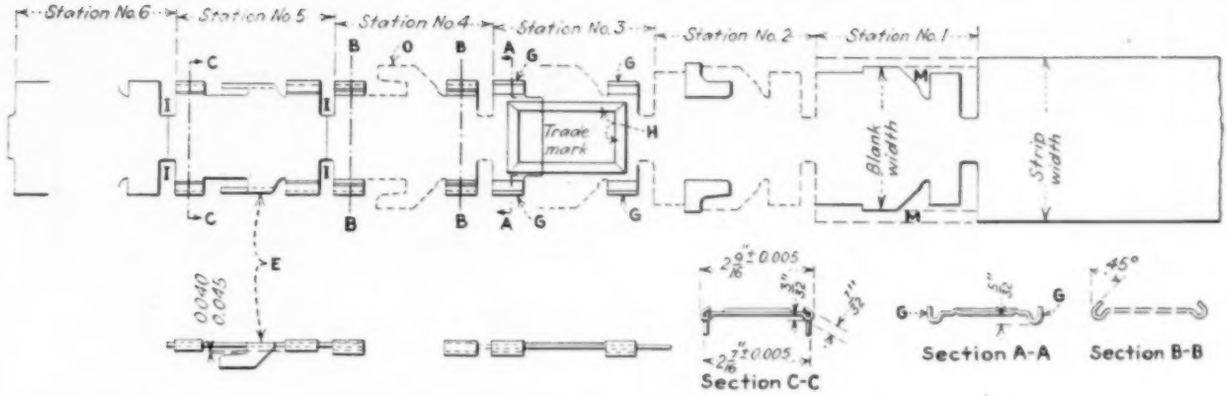


Fig. 1—The various operations on a clip requiring a six station die. Where usable, this type of die is economical to both make and use. This shows the different operations on the strip

A Six-Station Follow Die

EDWARD HELLER

THE present trend in die making seems to be toward station, or follow, dies. This practice is primarily an extension of the usual type of follow, or combination, die, with the addition of bending or operations other than blanking. In early days such dies were built on a bolster and a punch plate. The whole was considered a special machine. At present they are built like any other follow die and placed in the press when necessary. When its use is practical, the follow die is cheaper than any other type. In the first place the shape of the part is usually such that small sectional punches for notching the edges take the place of a full contour punch and die. In the second place, the material from which the punching is to be made can be used full width. This means less scrap, and what there is falls away from the die in small pieces instead of in a long strip. A good example of this is the new type of safety razor blade. Formerly these were blanked six at a time from wide strip, each of the six dies being a miniature sub-press die. The new type of blade is perforated and notched lengthwise, from a strip the width of the blade, and is then hardened and ground before being separated from the strip.

When its use is practical the follow die is cheaper than any other. It eliminates costly punch and contour dies, cuts down the scrap, and multiplies production. But it has limitations. Here, however, is a die in which most of the drawbacks are either eliminated or controlled

The limitations of the station type of die have previously been the bend-

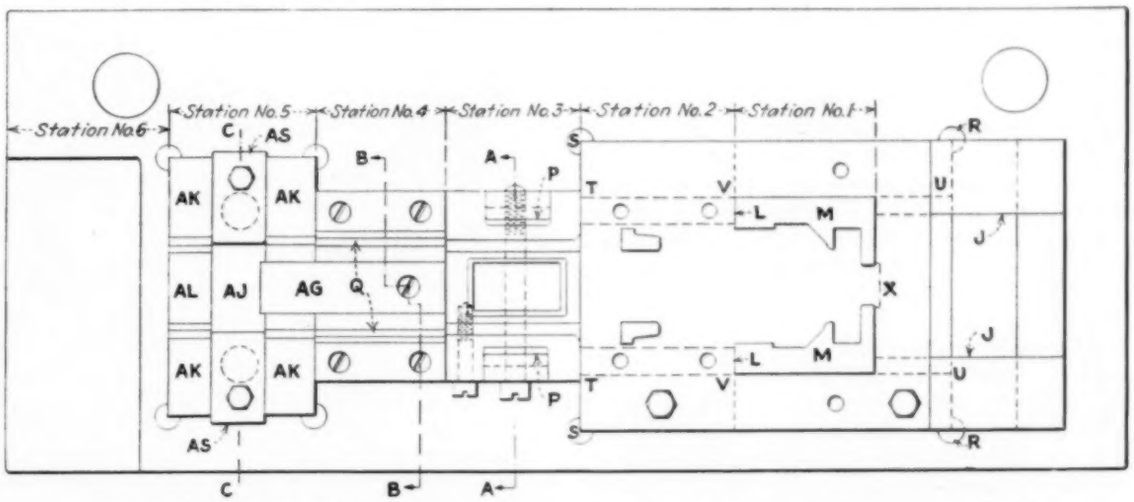


Fig. 2—Method of building up the various stations to perform the operations shown in Fig. 1

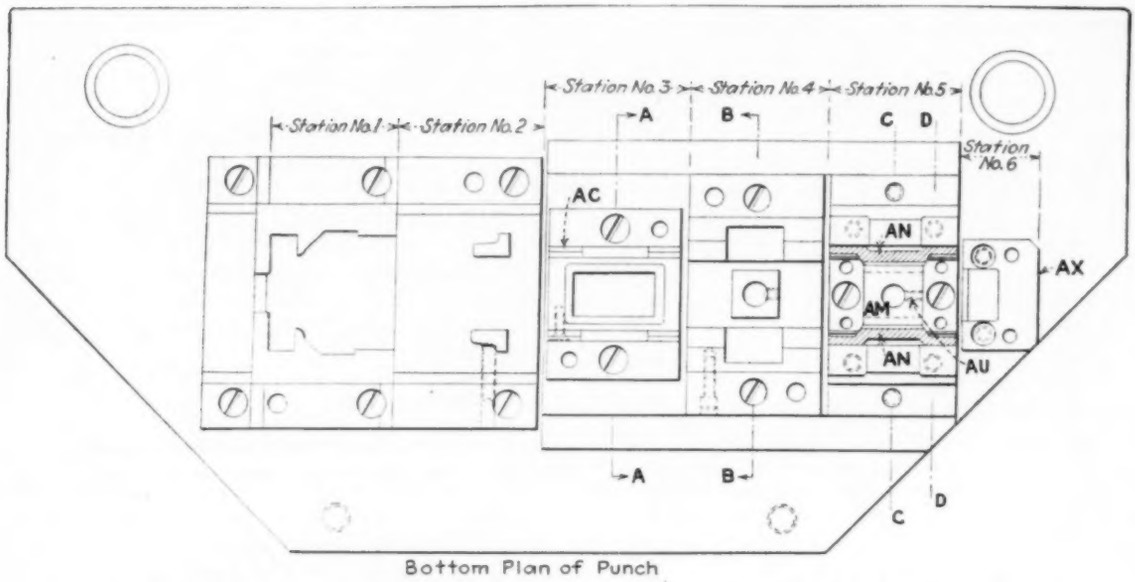


Fig. 3—A bottom view of the punch holder assembly. The different stations are shown from left to right as the punch is inverted

ing operations or, to be specific, the difficulty of guiding the strip when the bending operations took place early in the progression.

If ears were turned upward, the stripper had to be grooved, narrowed, or dispensed with for the rest of the distance; if ears were turned downward, the same was true of the die. The result was that it was difficult to guide the strip accurately. These difficulties still remain for certain shapes and contours, as does also the fact that provision for shimming either the punch or die must be provided, otherwise the punch must enter the die deeper than good practice warrants to compensate for loss by grinding.

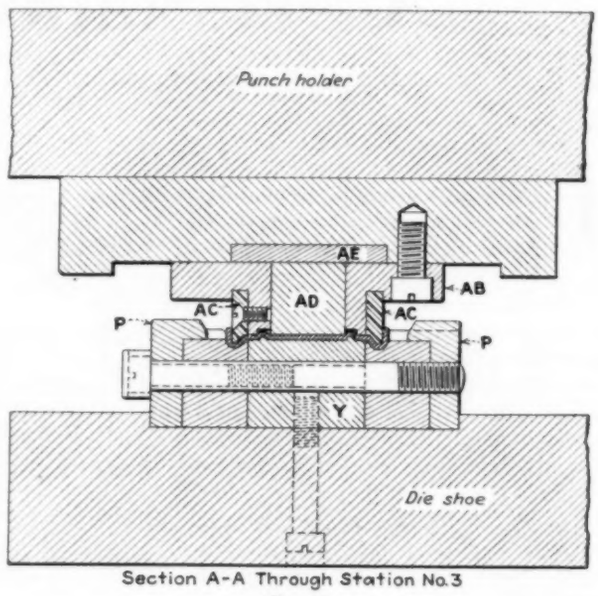
In the die described here, ears are bent in both directions and the strip is carried through several stations thereafter and guided accurately to the finishing operation. Other difficulties are either eliminated or taken care of. The line-up of the operations from the flat strip to the finished stamping is shown in Fig. 1. Some of the dimensions had to be held to close tolerances, and the die as a whole offered one or two problems that taxed the ingenuity of the designer.

Stations Nos. 1 and 2 do the cutting and prepare the blank for forming. The forming begins at station No. 3; over 75 per cent of the work is done at this station. The four ears *G* are "U'ed" up, the bead *H* is embossed, and a trade mark, filling almost the entire rectangular space inside of the bead, is hammered in.

Station No. 4 has very little to do, merely throwing the ears over from vertical to 45 deg., while at station No. 5, the stamping is finished complete, except for the fact that it remains attached to the strip. Station No. 6 shears through the line *I-I*, the completed job falls to the beveled face of the die shoe, and slides down to the left side of the press.

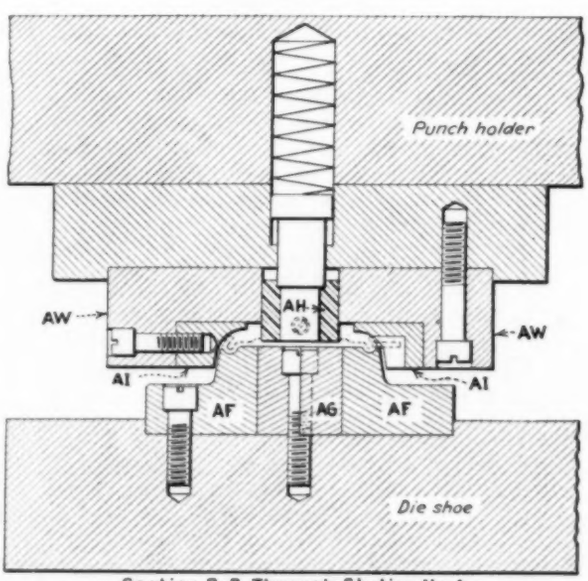
This is a job where the blank is carried along with the strip by a small neck until all the operations are performed. Then the neck is slit through and a finished stamping is separated from the rest of the material.

Fig. 2 shows a plan of the die and a front elevation of the assembled punch and die. The strip is slid in between the guide bars *J* and under the heavy stripper



Section A-A Through Station No. 3

Fig. 4



Section B-B Through Station No. 4

Fig. 5

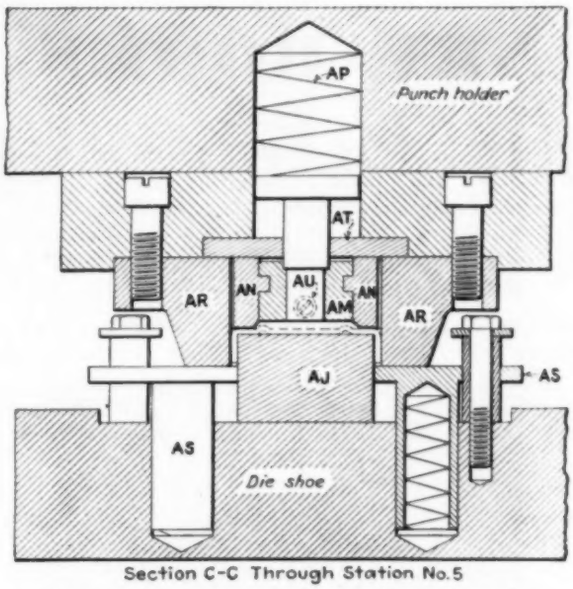


Fig. 6—A section through station No. 5, along the line C-C

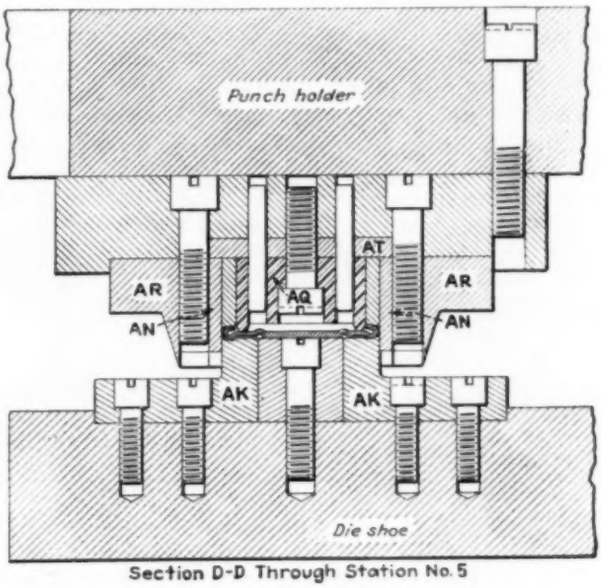


Fig. 7—Another section through station No. 5, along line D-D

K, stopping against the two tool-steel stops *L* which are just far enough apart to pass the blank between them, but not the strip.

At the first stroke of the press, the slugs *M* are notched out, leaving the two edges *V* to gage against the stops *L* during the next stroke. From now on, each notching operation makes a new gaging point for the next step.

When the blank reaches station No. 3, the two wings *O*, Fig. 1, fall in between the side gages *P*, Figs. 2 and 4, and help the gage bars *J* to keep the job in alignment. For the next two stages, Nos. 4 and 5, the partly formed stamping guides itself into the grooves *Q*, Fig. 2, which are a part of the die, and remains in line until it is cut off at the end.

For ease in building, and in subsequent upkeep of this die, all the working parts were built of as many pieces as was considered practical. The two cutting stations, Nos. 1 and 2 are built up from four individual pieces of steel, two side bars *RSTU*, a center piece *TVXVT*, and an end piece *UXU*. The center and end pieces are held tightly between the side strips, while the side bars are tongued together at *X*. The whole thing is set into a machine-steel shoe to a depth of $\frac{1}{4}$ inch.

Fig. 4 shows a section *A-A* through station No. 3. The die member is built up from three pieces, *Y*, the center part which has the bead worked out from the solid, and *Z* the two side pieces in which the *U*'s are formed. The gages *P* are set into the side pieces, and the whole thing is fastened together with a long screw through the middle of the entire assembly. This is in addition to the four smaller screws shown in the plan of the die.

The punch is made up of the rectangular ring block *AB*, with two inserts *AC* as the U-forming punches. *AD* is the trade mark stencil and *AE* is a heat-treated plate set into the machine steel above to take care of the hammering of the lettering.

Fig. 5 shows a section *B-B* through station No. 4. As was mentioned before, very little work is done at this point. The lower forming blocks *AF* are made of tool steel, while the center part *AG* is only a filler to hold the others apart. The upper member carries a spring pad which comes down a little ahead of the forming blocks and holds the strip tightly to prevent it from sliding to one side.

Figs. 6 and 7 show, respectively, sections *C-C* and *D-D* through station No. 5. This part of the die offered some interesting problems in design. The die consists of a central block *AJ*, Fig. 6, over which the hooks are bent down, and four side blocks *AK*, Figs. 7 and 2, upon which the four ears are finished to size. The four blocks mentioned are held apart by the filler *AG*, and the cutting-off block *AL*, Fig. 2. The punch, Fig. 6, is somewhat more complicated. It consists of a central block *AM* which carries, loosely, the finish forming blocks *AN*. The shape of these blocks can best be seen in Fig. 3 where they are shown cross etched in two directions to emphasize them better. In addition to this floating unit, which is held on a stud and actuated by spring *AP*, the punch at station No. 5 carries two straightening blocks *AQ*, Fig. 7.

Before the action of this part of the tool is explained, it will be well to note on Fig. 1, at section *A-A*, a dimension $\frac{5}{32}$, while at section *C-C*, this dimension is changed to $\frac{3}{32}$. Now, to go back to sections *C-C* and *D-D* at station No. 5. When the punch first comes down, the blocks *AR* force the hooks down over the block *AJ*. As the punch continues down, the outer ends of the loose blocks *AN* strike the edges of the ears. In doing this, the $2\frac{13}{32}$-in. dimension decreases slightly, but before the loose blocks are down home the wedge-shaped teeth of the straightening blocks *AQ* strike the stamping at four points near the ears and straighten them out, reducing the $\frac{5}{32}$-in. dimension to $\frac{3}{32}$ in. and forcing the metal tightly between the punch blocks *AR*, thus bringing the job to a size, depending on the width between the two punch blocks *AR*.

On the up-stroke of the press, the stripping fingers *AS* lift the stamping off the bottom block *AJ* while the spring *AP* keeps it out of the upper member. The end of the strip is now lying free on top of the die ready for the next stroke, at which time the stamping is cut loose from the strip at station No. 6 by means of the cut-off punch *AX*, Figs. 2 and 3. A hardened tool steel

plate *AT*, Figs. 6 and 7, takes the hammering of the forming blocks *AN* and prevents them from sinking into the softer machine steel.

A die which was the forerunner of this job was built with all the notchings in one station, but it was found that the weak hook sections *O-O*, Fig. 1, which were left unsupported did not stand up well and had to be replaced often because of breakage. The forming members wore at such different rates that every few weeks a different important part of the die had to be replaced because of one little worn spot. That led to the separate die blocks *Z* and forming punches *AC*, at station No. 3.

•

70 corporations, firms and individuals furnished data and photographs.

8 authorities reviewed the preliminary drafts.

5 leaders in the welding field acted as a committee to pass on the final articles.

The first of a series describing what is what in gas-cutting, automatic shape-cutting, manual and automatic electric welding of machinery and related equipment will begin in an early issue of *American Machinist*.

•

Then station No. 4, which was the last place to expect trouble from, made its contribution. It was found that the blanking parts of the die would throw up a larger burr on the ears on one side than on the other, that the ears with the larger burrs would stick to the punch, forcing the strip over to one side. The spring pad *AH* relieved a part of the trouble, but when the solid punch block *AW* was machined out to receive the forming blocks *AI* and these blocks were made of high-grade steel and the working faces kept polished, the trouble disappeared.

Station No. 5 offered a few problems, but one by one they were solved. One of the difficulties was to maintain the 0.040-0.050-in. dimension in the face of the variations in stock temper, and commercial allowances in thickness. With the separate pieces, both in the punch and the die, it was comparatively simple. Shimming up block *AJ* would square the corners more sharply and take up more metal. The dimension in question was then shortened. On the other hand, if the block was allowed to sink lower by removing the shims or grinding off some from the bottom, the pressure from the forming punch was reduced, the corners were formed somewhat rounded, and the drop in the hooks was increased. The entire unit in the punch at this point can be taken out for correction or adjustment by loosening the setscrew *AU*, Figs. 3 and 6.

The same is true of other parts of the job. Every member that is likely to wear excessively or to require adjustment is designed so that it can be removed from the die while the latter is in the press, and in most cases without disturbing much of anything else around the die. The die is run successfully on an open-side inclinable geared press of about 90-ton capacity.

NEW BOOKS

GUIDANCE AT WORK—*By Stuart and Morgan, Principal and Vice-Principal respectively at Arsenal Technical Schools, Indianapolis, Ind. 104 pages, 5 x 7½ in. Cloth board covers. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $1.60.*

This book is a description of the working-out of the guidance principle in education. While new to the present generation, it is in reality an attempt to get back to the little red school house type of education, where the teacher understood the mental qualifications of each of his or her pupils, and helped each according to his requirements and possibilities. Not all the pupils of the l.r.s. were wonders in after years, but most of those a good teacher singled out for special attention, made their mark. In science and industry, America is today reaping the harvest of the country school house and McGuffey's fourth reader.

From reading the book one gathers that a different class of teachers are necessary. Taking this fact in conjunction with the current criticism of teacher quality, in our large cities especially, the application of the guidance principle will possibly be limited because of lack of teachers. Such a method of teaching demands enthusiasm and intelligent interest, not merely by attendance and routine.

One of the encouraging signs is that boys are taught by men, girls by women. Notwithstanding our praises of our early teacher, we have always had the idea that it was just as difficult for a woman to make a man out of a boy, as it would be for a man to train a girl to be a woman.

There are many questions that occur to one. For instance, whether a child is really competent to know what is best for it—whether the teachers have had sufficient practical training to act as a guide—whether the preplanning is of any real use in fixing the vocation, or whether the first opportunity is not the deciding factor, in accepting a position.

The function of a review is not to make it unnecessary to read the book, but there are so many common sense things in the guidance principle, and it is so obviously a move to get education back on a sane basis, that it inspires hope in those who have been "educationally" pessimistic.

Results are what count; in the class of 1929, 512 pupils entered college and 308 went into industry. The Arsenal Technical School faculty not only advised and trained them, but it placed most of those who sought positions.

S.A.E. HANDBOOK 1931 EDITION—*750 pages, 4¼x7¼ in.. Clothboard covers. Published by Society of Automotive Engineers, 29 West 39th St., New York, N. Y. Price $5.00 to non-members.*

This handbook gives in concise form the practices and findings of the automotive industry; over 600 specifications of standards and recommended practices are given including the date of revision of each one. The arrangement of data is convenient and easily found. The volume is too well known to need extended description.

R. C. Gray
General Superintendent,
Worthington Pump & Machinery Corporation

ADMINISTRATION THROUGH PERSONNEL

More eloquent than words in preventing waste

IT WAS formerly believed that economic production control was a matter of efficient mechanical training and that the one having such training, made the best foreman or executive—other things being equal. Possibly that belief was true at the time, and mechanical training was the first step in management. We have, however, outgrown that stage, and today the problems of management have become problems of leadership. It naturally follows that certain personal qualities must be present in the leader of any group or organization. It is likewise evident that the reward of leadership, material benefits, personal achievement, remuneration and contentment must be satisfactory to the individual, and nothing done to diminish this individuality. Under competent leadership the benefits derived from such an arrangement will be greater to the organization than to the individual.

The concensus of current opinion is that people are not interested sufficiently in their occupation. Consequently a high pitch of energy is not maintained, and as many leaders lack sufficient intelligence, maximum results will not be obtained unless there is a psychological impetus based on material rewards other than remuneration, no matter what other methods are used to cause useful activity.

Within a few years there has been a decided change in the attitude of management towards workers, and vice versa. Both are closer together today than ever before. Not only for the purpose of acquiring wealth, but through the realization that there is something deep rooted and forceful in human relationships.

Achievement in an organization is the result of co-ordination of thought put into execution through co-operation by personalities. The Worthington Corporation has persevered in its policy of education along mechanical and personal lines in the development of its organization and products. The result has been greater efficiencies along parallel lines than are obtained in most other instances. The quality of workmanship and efficiency in performance of our product are tributes which users voluntarily offer, and these facts could only be obtained by efficient humans dealing with inert material.

Various educational methods are employed, such as attractive tabulation of shop operations, which present the balance between good and poor performance in a way that cold figures, such as a graph would show, cannot convey.

Bulletins of various kinds help to keep significant facts to the fore and stress such points as:

Pride in Corporation, shop and self.
Appreciation of good efforts.
Knowledge of service conditions and product.
Waste and prevention.
Accidents and prevention.
Cleanliness and orderliness.
Planning and production.
Personnel and co-operation.

Aside from our internal educational plans we have been fortunate in securing the co-operation of Rutgers University and the question has arisen in the minds of many as to whether or not outside help in leadership has been a successful factor in helping attain better results. This matter was discussed recently at Rutgers University and a few of the methods to illustrate the reasons for the contention were outlined.

There is no question that outside leadership is to be desired, it is an influence from which we cannot be detached any more than there can be such a thing as success where there is isolation. The small things of this life

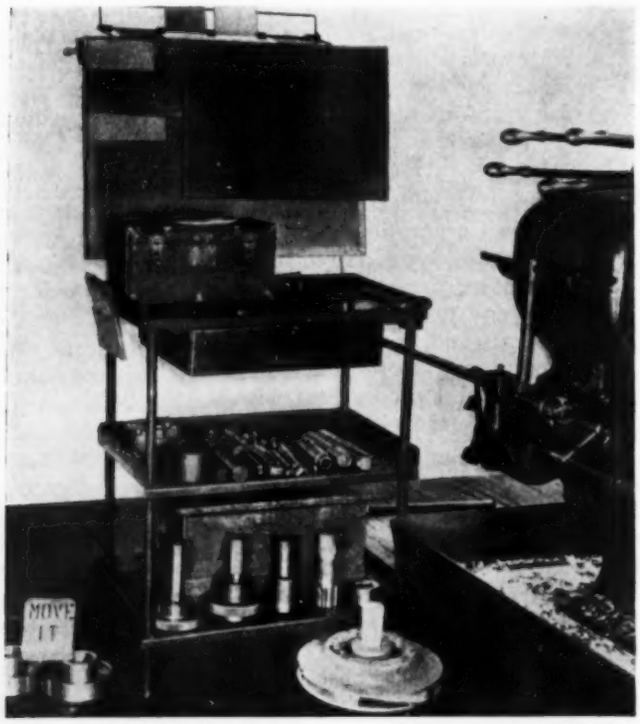
are often the ones of greater importance and the more we develop, the more insignificant the problems seem, when we sum it up there are no really large difficulties when one is making progress. I mention some of these little things to illustrate some basic reasons for my opinion that interest is easier to create and hold by leadership from outside the organization.

Primarily air and water are composed of atoms each of which is dependent upon the other. Life itself is closely allied with and is dependent upon other factors outside of itself. Habit is a factor. We read the newspaper as a habit and sometimes absorb data of interest, which we later apply. Our children are sent to school because there are those who have developed better methods of education than we have had time or energy enough to acquire. Immediate associations do not cause us to extend our thoughts beyond their habitual trend. Being creatures of habit, we become associated or engaged in employment which is congenial and in which we become proficient. Various phases of our occupation absorb our interest to a degree.

Some details of our work are dependent upon factors of which we have little knowledge, nor have we given sufficient thought to the details involved. Psychologists assert that a very small portion of our minds function and therefore we miss many interesting facts.

The problem the executive is confronted with, is how to make work more interesting and, therefore, more productive. Obviously, production depends upon interest, for no one ever saw a man in a chain gang with a whip over him, exert himself any more than he was made to. Money is a sugared whip, but maximum results will not be obtained by this means alone.

Formerly a foreman was given a group of men and told that they were his gang, here was his shop, his tools, etc. Then he was left to his own resources to get results in whatever manner he saw fit. Maybe he was called into the boss' office at the end of several months and told his costs were high or his deliveries were late and that he would have to do better. The old time foreman was given little or no help. The newer foreman may not have had the advantage of long time contact with the fundamentals of fabrication, but he is placed in a different atmosphere, and it is realized that he must have other tools than machine tools to work with. He has a broader idea of the essentials required of a progressive shop foreman. His costs are segregated and analyzed for him and he is shown wherein one factor affects another. The planning department and its staff outline the methods, etc., in fact, most of the details are fixed and definitely determined. The human element, for which he is responsible, is left to his guidance and leadership to co-ordinate intelligently and clearly the interests of both workers and management.



Everything required for the job, and the job itself

Our associates, by familiarity, lose many of the important details. Consequently newer interests are more interesting. An article in a technical magazine creates new thoughts, along parallel lines. Our state safety first movement with its accumulation of statistics of maimed humans creates an impression which cannot be disregarded, and yet those adjacent to the work may have been instructed with the necessity for caution, possibly with only a half hearted response. A talk by one of the district safety supervisors accomplishes more than shop supervision could. Foremen learn what all this safety first talk is about and their general efficiency is improved as a result. They learn interesting facts, which may be substantiated by figures available to the shop.

In some newer developments of planning, some of the mechanics do not see the whole picture. We then have engineers, through arrangements with the foremen, explain in detail the reasons for the change, and a demonstrator perform the newer operations for the mechanics. In one case several of the mechanics were interested sufficiently to fall in line and several were not. The latter in a few days were convinced, through interest in the progress of the others.

In our own environment, however clever we may be, we have our preferences, our topics of special interest, the subjects we excel in. The details of these influence our actions so that we deviate but little. An outsider sees a different picture. His characteristics may be the same as ours, but his thoughts react along different lines, although maybe on the same subject. His methods of expression is also different. The outsider may be interested in the same thing that an organization is trying to put over, but facts and figures carry more weight from an outsider. Try it on your boy—he pays attention to what you say but it does not soak in. Get a friend of the boy to tell him the same thing and see what happens. It is human nature.

■

THE STORY of a link belt invention and of the part this invention played in the development of the Link-Belt Company was related recently by George P. Torrence, Vice-President of the company. "A man named Ewart, trying to build a harvesting machine in 1874, developed a new form of link belting," he said. "Plans for the machine were carried to Chicago, where a group of financiers, thinking better of the belting than of the harvesting machine, agreed to finance a belt manufacturing company."

THE ADVANTAGES of industrial standardization have long been recognized by executives and operators. But progress in this direction, though gratifying, has scarcely scratched the surface. In this article, the author points to the need of standardized machine drives

GEOMETRIC PROGRESSION IN MACHINE TOOL SPEEDS

J. DECKER
U. S. Rubber Company

THE National Machine Tool Builders' Association gives the following recommendations for machine-tool standardization:

1. Standardize designations and capacities, and establish a method of power rating.
2. Standardize devices for holding cutting tools.
3. Standardize devices for holding work and fixtures.
4. Standardize operation movements.
5. Standardize parts concerned in the setting up of machines with reference to the permanent shop equipment.
6. Accept the geometric progression ratio as a fundamental requisite in designing feeds and speeds.

Considerable progress has been made in adopting the foregoing recommendations, except No. 6. Very little attention has been paid to the standardization of the geometric progression ratios of feeds and speeds. The need for such standardization is evident if the economical output of machine tools is considered. This concerns users of machine tools. The simplification resulting from standardization will aid the designers and builders of machine tools as well.

It is general practice today to vary the speeds in machine-tool drives in geometric progression. Arithmetical progression was found to be impractical because it groups speeds too far apart at one end of the range and too closely at the other. What is needed now is to standardize the application of geometric progression to a specific number and range of speeds.

The formula for geometric progression is:

$$r = \sqrt[n-1]{\frac{b}{a}}$$

where:

b = slowest speed
a = fastest speed
n = number of speeds
r = ratio.

In most machine shops are found different makes of tools of the same class. Under the present practice, a uniform output cannot be obtained where this condition exists. The only way that a manufacturer can obtain this desirable result is to purchase all his machine tools of a given class from a single manufacturer.

A tabulation of five well-known makes of lathes will serve to illustrate the existing lack of system in the application of speed ratios. Lathes are chosen as the most common type of machine tool, but the same differences may be found in other machines. Table I is a compilation of data on the sizes and corresponding speeds of five makes of lathes. As most catalogues do not give all the intermediate speed values, these were computed using the above formula. The ratio r then represents the average ratio between each two successive speeds. In practice, variations from the theoretical geometric speeds are seldom more than five per cent. Any greater variation would add to the confusion that already exists. The last column gives the overall ratio for the full speed range. Table I reveals that the geometric progression ratio r, the total speed ratio, and the maximum and minimum speeds differ with every make of lathe and almost with every size.

A manufacturing department may have a number of lathes of the same size but different makes grouped together, and these will have different speed ratios and different maximum and minimum speeds. For instance five lathes of the 12-in. size with geared headstocks made by companies *A*, *B*, *C*, *D* and *E* show ratios of 1.36, 1.43, 1.35, 1.69 and 1.4, minimum speeds of 18, 20, 23, 9 and 12, maximum speeds of 540, 350, 604, 359 and 450 and total speed ratios of 30, 17½, 26.2, 40 and 37½ respectively. Such variations may be found throughout the whole machine tool field. Considering only lathes *A*, *B* and *C*, which show the least variation, the relation of speed ratio and speeds to output is clear from the following example:

TABLE I—The speed ranges and ratios of

Size Lathe	Manufacturer A								Manufacturer B							
	Geared				Cone				Geared				Cone			
	No. of Speeds	Range	γ	φ	No. of Speeds	Range	γ	φ	No. of Speeds	Range			No. of Speeds	Range	γ	φ	No. of Speeds
12-in.	12	18–540	1.36	30	18	19–534	1.22	28	9	20–350	1.43	17½	18	16–375	1.2	23½	12
14-in.	12	18–540	1.36	30	18	18–540	1.22	30	9	20–350	1.43	17½	18	16–375	1.2	23½	12
16-in.	12	14.5–400	1.35	27½	18	12½–354	1.22	27½	12	15–330	1.325	22	18	13–300	1.2	23	12
18-in.	12	13–354	1.35	29½	18	12–348	1.22	29	12	15–330	1.325	22	18	12–300	1.325	22	12
20-in.	12	13–354	1.35	27.2	18	12–330	1.215	27½	16	10–300	1.25	30	18	10–300	1.22	30	12
22-in.	12	9–351	1.40	39	18	10–340	1.23	34	16	10–300	1.25	30	18	10–300	1.22	30	..
24-in.	12	8–313	1.34	36.8	18	10½–338	1.227	22½	16	8–300	1.27	37½	18	9–300	1.23	33½	9
26-in.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27-in.	12	7–281	1.40	40½	18	9–313	1.23	34.8	16	8–300	1.27	37½	18	9–300	1.23	33½	..
28-in.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30-in.	12	7–260	1.39	37.2	18	7–312	1.25	44½	16	4–225	1.31	56½	18	7½–300	1.24	40	..
32-in.	..	..	..	..	..	..	..	..	16	4–225	1.31	56½	18	7½–300	1.24	40	..
36-in.	12	7–260	1.39	37.2	18	7–312	1.25	44½	16	4.225	1.31	56½	18	7½–300	1.24	40	..
	18	1.85–240	1.33	130	..	.....	.....	....	..	.....	....	....	..	.....	....	....	..
42-in.	18	1.65–213	1.34	129	..	.....	.....	....	..	.....	....	....	..	.....	....	....	..
48-in.	18	1.65–213	1.34	129	..	.....	.....	....	..	.....	....	....	..	.....	....	....	..

Assume that a 3-in. diameter shaft is to be machined on one of these three lathes, a condition commonly met in practice. Taking a theoretical cutting speed of 100 ft. per min. and applying the following formula:

$$S = \frac{D \pi R}{12}$$

where:

D = diameter of the shaft in inches
R = number of revolutions per minute
S = surface speed in feet per minute.

Charts, 1, 2 and 3 are plotted from this formula and show clearly the relations of R and D to S.

Chart 1 shows that the lathe must be run at 114 r.p.m. which results in a cutting speed of 90 ft. per min. Chart 2 shows 120 r.p.m. with a cutting speed of 94 ft. per min. Chart 3 shows 102 r.p.m. with a cutting speed of 80 ft. per min. A uniform output from these three lathes is impossible should all three be employed on a job according to the specifications given. The drop from the theoretical speed is $A = 10$ per cent, $B = 6$ per cent, and $C = 20$ per cent. The percentage drop in cutting time of the machine with the highest deviation from the theoretical speed compared to the lathe with the least deviation is:

$$\frac{(94 - 80) \cdot 100}{94} = 15 \text{ per cent.}$$

Thus for the same operation, the cutting time on lathe C is 15 per cent less than on lathe B. It would not materially improve the condition to run lathe C with the next higher number of r.p.m. as the variations between the different machines could not be eliminated. Besides, this would not be in keeping with the original premise of a 100-ft. cutting speed limit.

As the charts show, the drop between two successive speeds in a given machine is constant when geometric progression is used. The ratio r measures the maximum drop in speed between two successive speeds.

Expressed in per cent:

$$\text{Drop in speed in per cent} = \frac{r - 1}{r} \cdot 100$$

The smaller this drop, the more economically a machine tool may be used as the output of the machine will diminish with the percentage drop in speed from that desired. Naturally the most favorable performance would be attained if the cutting speed corresponded to the character of the material to be cut, the requirements of the work, and the type of tool used.

The percentage drop in successive speeds is in the case of:

$$\text{Lathe } A \; \frac{1.36 - 1}{1.36} \cdot 100 = 26\tfrac{1}{2} \text{ per cent}$$

$$\text{Lathe } B \; \frac{1.43 - 1}{1.43} \cdot 100 = 30 \text{ per cent}$$

$$\text{Lathe } C \; \frac{1.35 - 1}{1.35} \cdot 100 = 25.9 \text{ per cent}$$

The slight difference in the drops of lathes A and C would be immaterial if the lathes were based on a standard series. Since this is not the case, the variations before outlined are evident and complicate the work of those who are concerned in the performance of machine tools. This condition actually exists in many shops and will continue to exist as long as machine tools are not standardized with a view to uniform output. Among machines of the same size designed for the same purpose, there is no reason why one machine should have a total speed ratio of 22, a second one of 29 and a third one of 38, minimum speeds of 15, 13 and 10 and maximum speeds of 330, 354 and 380 respectively.

Standardization of speed ratios and the determination of a series of speeds to choose from will greatly contribute to the economy and uniformity of machine-tool output. Once a standard is established, the designer should have no objection to applying it, as this standard would embody the composite experience, observation and co-operation of machine tool builders. Therefore, he should not consider himself concerned with further development of gear drives on machine tools, realizing that adherence to the standard would be a matter of course.

Today the design of gear drives for machine tools is

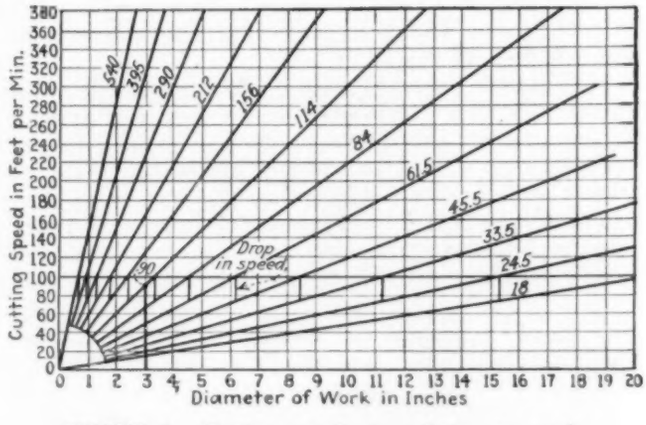


CHART 1—Cutting speeds in relation to work diameter and spindle r.p.m. for the geared head lathe made by manufacturer *A*

five makes of lathes show wide variations

Manufacturer C								Manufacturer D								Manufacturer E			
Geared				Cone				Geared				Cone				Geared			
Range	γ	η	No. of Speeds	Range	γ	η	No. of Speeds	Range	γ	η	No. of Speeds	Range	γ	η	No. of Speeds	Range	γ	η
23–604	1.35	26.2	16	12–486	1.28	40½	8	9–359	1.69	40					12	12–450	1.4	37.5
17–450	1.35	26½	16	15–478	1.26	31.8	20	7.5–440	1.224	58.7	18	15–329	1.216	21.9	12	10–397	1.4	39.7
							18	15–329	1.216	22								
12–382	1.37	31.9	16	9–462	1.3	51.3	8	9–359	1.69	40	18	13.8–300	1.18	21.7	12	10–354	1.38	35.4
10–380	1.39	38	16	8–580	1.32	72½	8	12–385	1.65	32	18	10–320	1.21	32	12	8–342	1.41	42.7
9.5–373	1.39	39.3	16	7–450	1.32	64.2	..	.....	.....	.....	18	12–300	1.21	25	12	8–320	1.40	40
.....	.....	.....	..	.....	.....	.....	.....	.....	.....	.....	18	11.7–346	1.21	29.6	...	.....	.....	.....
8–255	1.54	32	16	6–395	1.32	65.9	12	9–359	1.40	40	18	9–225	1.2	25	12	6.7–280	1.4	41.8
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	9.5–300	1.21	31.6	...	.....	.....	.....
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	12	6.7–280	1.4	41.8
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	7.8–246	1.21	31.6	...	.....	.....	.....
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	6.9–300	1.23	43½	16	3.98–287	1.33	72
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	6.4–236	1.22	37	...	.....	.....	.....
.....	.....	.....	..	.....	.....	.....	18	1½–175	.....	11½	18	6.4–236	1.22	37	12	6–260	1.41	43.3
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	1.82–157	1.30	86.5
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	1.82–157	1.30	86.5
.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	..	.....	.....	.....	18	1.82–157	1.3	86.5

governed by individual personal views as to what constitutes an economical machine. The result is the present lack of system. In establishing a standard, the paramount aim should be to overcome possible difficulties among those who may try to co-operate in developing this standard.

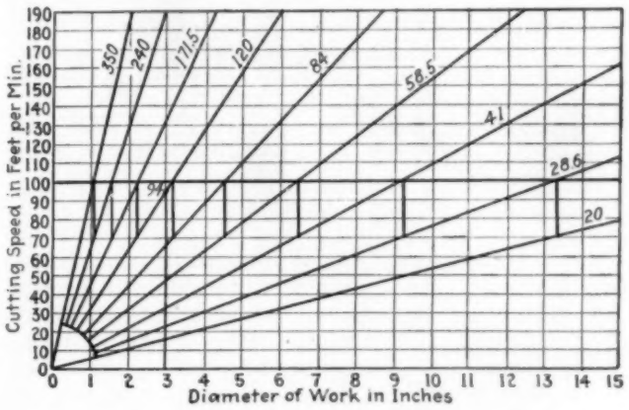


CHART 2—The quantities shown in Chart 1 for the lathe made by manufacturer *B*

Professor G. Schlesinger of the Technical University of Berlin, in co-operation with others, has worked out a system of standardized ratios and speeds. If this is approved by the German Standardization Committee, it will mark a decided advance in the standardization of machine tools. American machine tool builders and users could only benefit by setting up a similar system. The German system coincides with the standardized speeds of electric motors, pulleys, and shafting and is applicable to every design of change-gear drives.

Professor Schlesinger established six ratios in three groups:

$$0\begin{cases}\text{Extra fine ratio} & 1.06=\sqrt[12]{2}=\sqrt[40]{10}\\ \text{Fine ratio} & 1.12=\sqrt[6]{2}=\sqrt[20]{10}\end{cases}$$

$$1\begin{cases}\text{Main ratio I (basic)} & 1.26=\sqrt[3]{2}=\sqrt[10]{10}\\ \text{Coarse ratio I} & 1.58=\sqrt[5]{10}\end{cases}$$

$$2\begin{cases}\text{Main ratio II} & 1.41=\sqrt[2]{2}\\ \text{Coarse ratio II} & 2.00=2\end{cases}$$

From these values a series of speeds has been selected using a basic ratio of 1.26. This ratio has an advantage in that the same numbers repeat themselves in every decade because $1.26=\sqrt[3]{2}$ as well as $\sqrt[10]{10}$. Also it was possible to tie in the speed ratio 2:1 of the pole-shifting motors. The starting number of the series is put at 0.019 in order to include all possible speeds of electric motors.

Most machine tools employ one of the following motor drives:

1. Constant-speed drive—a.c. or d.c. current.
2. Adjustable-speed d.c. motor drive.
3. Multispeed motor drive (3-phase induction motor).

The application of these depends on the available current; therefore, the drive must be selected accordingly. The most common motor speeds as found in catalogues are listed below, corresponding to the foregoing classification 1, 2 and 3:

1. a. a.c. no-load ratings—3,600, 1,800, 1,200, 900, 720, 600, 514, 450.
   b. d.c. full-load ratings—3,500, 2,100, 1,900, 1,875, 1,850, 1,750, 1,725, 1,515, 1,375, 1,350, 1,200, 1,180, 1,150, 1,050, 1,000, 900, 850, 575 (d.c. full-load ratings).
2. c. Three-to-one ratio—250–750, 300–900, 400–1,200, 450–1,350, 500–1,500, 550–1,650, 600–1,800, 650–1,950, 700–2,100.
   Four-to-one ratio—250–1,000, 300–1,200, 400–1,600, 450–1,800, 500–2,000.
3. d. Two speeds 1,800–900, 1,200–600.
   Four speeds 1,800–1,200–900–600.

In Table II, the German series of standard speeds is given. The extent to which electric motor speeds could be combined with a standard series is easily ascertained by comparing Table II with the listed motor speeds.

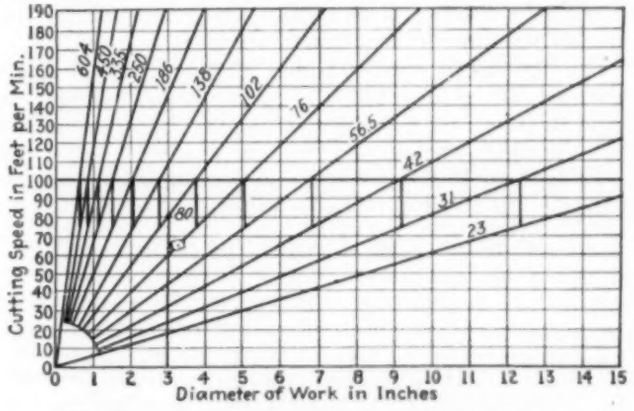


CHART 3—The same as Charts 1 and 2 but for the lathe made by manufacturer *C*

TABLE II—Professor Schlesinger prepared these geometric series for the consideration of the German Standardization Committee

Extra Fine	Fine	Main Ratio I	Coarse Ratio I	Main Ratio II	Coarse Ratio II
		RATIOS			
1.06	1.12	1.26	1.58	1.41	2.0
0.190	0.19	0.19	0.19	0.19	0.19
0.200					
0.210	0.21				
0.225					
0.235	0.235	0.235			
0.250					
0.265	0.265			0.265	
0.280					
0.300	0.300	0.300	0.300		
0.315					
0.335	0.335				
0.355					
0.375	0.375	0.375		0.375	0.375
0.400					
0.420	0.420				
0.450					
0.475	0.475	0.475	0.475		
0.500					
0.530	0.530			0.530	
0.560					
0.600	0.600	0.600			
0.630					
0.670	0.670				
0.710					
0.750	0.750	0.750	0.750	0.750	0.750
0.800					
0.850	0.850				
0.900					
0.950	0.950	0.950			
01.00					
01.05	1.05			1.05	
01.120					
1.18	1.18	1.18	1.18		
1.25					
1.32	1.32				
1.40					
1.50	1.50	1.50		1.50	1.50
1.60					
1.70	1.70				
1.80					
1.90	1.9	1.9	1.9		
2.00					
2.10	2.1			2.1	
2.25					
2.35	2.35	2.35			
2.50					
2.65	2.65				
2.80					
3.00	3.00	3.00	3.0	3.0	3.0
3.15					
3.35	3.35				
3.55					
3.75	3.75	3.75			
4.00					
4.20	4.2			4.2	
4.50					
4.75	4.75	4.75	4.75		
5.00					
5.30	5.3				
5.60					
6.00	6.0	6.0		6.0	6.0
6.30					
6.70	6.7				
7.10					
7.50	7.5	7.5	7.5		
8.00					
8.50	8.5			8.5	
9.00					
9.50	9.5	9.5			
10.00					
10.50	10.5				
11.20					
11.8	11.8	11.8	11.8	11.8	11.8
12.5					
13.2	13.2				
14.0					
15.0	15	15			
16.0					
17.0	17			17	
18.0					
19.0	19	19	19		
20.0					
21.0	21				
22.5					
23.5	23.5	23.5		23.5	23.5
25.0					
26.5	26.5				
28.0					
30.0	30	30	30		
31.5					
33.5	33.5			33.5	
35.5					
37.5	37.5	37.5			
40.0					
42.0	42				
45.0					
47.5	47.5	47.5	47.5	47.5	47.5
50.0					
53.0	53				
56.0					
60.0	60	60			
63.0					
67.0	67			67	
71.0					
75.0	75	75	75		
80.0					
85.0	85				
90.0					
95.0	95	95		95	95
100.0					
105.0	105				
112.0					
118	118	118	118		
125					
132	132			132	
140					
150	150	150			
160					
170	170				
180					
190	190	190	190	190	190
200					
210	210				
225					
235	235	235			
250					
265	265			265	
280					
300	300	300	300		
315					
335	335				
355					
375	375	375		375	375
400					
420	420				
450					
475	475	475	475		
500					
530	530			530	
560					
600	600	600			
630					
670	670				
710					
750	750	750	750	750	750
800					
850	850				
900					
950	950	950			
1000					
1050	1050			1050	
1120					
1180	1180	1180	1180		
1250					
1320	1320				
1400					
1500	1500	1500		1500	1500
1600					
1700	1700				
1800					
1900	1900	1900	1900		
2000					
2100	2100			2100	
2250					
2350	2350	2350			
2500					
2650	2650				
2800					
3000	3000	3000	3000	3000	3000
3150					
3350	3350				
3550					
3750	3750	3750			
4000					
4200	4200			4200	
4500					
4750	4750	4750	4750		
5000					
5300	5300				
5600					
6000	6000	6000		6000	6000
6300					
6700	6700				
7100					
7500	7500	7500	7500		
8000					
8500	8500			8500	
9000					
9500	9500	9500			
10000					
10500	10500				
11200					

However, since motor speeds are listed under "full-load" and "no-load" ratings it is important to use only one rating as a base. It is more practical to use the "no load" rating because it is uncertain how much the speed will vary from no load to full load. The "no-load" rating is a known and unchangeable factor thus serving as a definite basis.

Once the value of standardized speeds is recognized, co-operation between machine tool builders and motor manufacturers becomes essential. Whatever drive is selected for a machine tool, the standard speeds should be adhered to. Gear transmissions should be designed in such a manner that any drive may easily be adopted. A degree of standardization in gear transmissions would be the consequence. A standard gear box could be designed for any kind and class of machine tool. If necessary, a few changes could be made to obtain the desired final speeds without changing the center distances of the gear shafts. It is a great advantage to have the gear shafts running at standard speeds.

The number of contact points of speed control apparatus should be standardized. The use of too small a ratio, such as 1.06 for example, is open to objection for the following reason: electric motor speeds may vary under load up to ten per cent. Assuming the maximum variation, the smallest ratio r which should be selected is:

$$\frac{r-1}{r} \cdot 100 = 10$$

$$r = \frac{10}{9} = 1.11$$

This ratio corresponds approximately to 1.12 in Table II. Of course, a drop in speed must be expected with every ratio chosen, but the ratio should not be so small that it will be overlapped by the speed variation. An effective speed control can be obtained if every machine having a small speed ratio is equipped with a revolution counter or tachometer and with a table showing the r.p.m. and corresponding cutting speeds in relation to the diameter of the tool as in a milling machine, or to the diameter of the work as a lathe. At any rate, every machine tool should be furnished with such a table. The machines driven by an adjustable-speed motor or those having a low speed ratio could be run most economically with tachometer speed control. Then it is easy for the foreman and the worker to adhere to the speeds given on the instruction or operation cards. A standardization of machine-tool speeds and also feeds would relieve the user of a great amount of work which must of necessity be done under existing conditions. Machine-tool records, operation calculations, time and motion study, estimating, and rate setting would all be simplified.

To get the most out of a machine shop it is usually advisable to group together all machines of the same class and size having the same speed ratios. Sometimes it is advantageous to rebuild machines to bring the speed ratios to a common level. However, this procedure should not be undertaken unless a profitable return justifies the investment. This pertains mostly to cone-pulley driven lathes. With the establishment of standard speeds, much of the difficulty of maintaining efficient production would be eliminated. There is also the possibility of including a system of preferred numbers in the standardized speeds. It will not be a simple matter to make these suggestions effective, but if the value of the results is appreciated, the labor will be worth while.

The above facts are presented in the hope that the deficiencies of the present conditions will be recognized. It is believed that improvement through standardization is a necessity.

"Stealing the Trade"

An old-timer considers machinists in general and recounts some anecdotes about one machinist in particular

TOM WHITE

AS FAR AS I KNOW there is but one statue of a machinist, as a machinist, in the United States today. That is the statue of Seth Boyden. Boyden was a machinist and an inventor, but the artist has depicted him with the leather apron of a blacksmith, standing at an anvil. That, I suppose, is the average sculptor's conception of a machinist. However, we will not quarrel about a little thing like that. The fact that gear wheels are seldom made with a hammer and anvil does not alter the fact that a lot of people think that is the way they are produced. That is, if they think at all. But speaking of the blacksmith, what a breed he has sired! Wherever one has settled civilization has blossomed. The machinist is the legitimate son of the blacksmith, and like his mighty sire he bends the fractious metal to his will. Look where you will, wherever men congregate, the work of the machinist is visible. In all the fields of war, transportation, communication, farming, building, mining, in fact in every phase of our modern civilization, the machinist has supplied the means to carry on.

Every important invention that has ever been made has been the father of hundreds of attendant inventions that no one ever hears of. In every machine shop and toolroom throughout the land, there is being produced every day some new device or new method of doing a job that should rank as an invention. It is not uncommon for a machinist to produce an idea that revolutionizes the entire production of a shop. And only one single statue to him!

When I say machinist, I include the engineer, the blacksmith, the patternmaker, and the molder. The same creative urge is strong in each of them. They belong to the same clan, differing only in the amount of dirt they accumulate in the day's work. They tell me the old-time all-around machinist is taking his place with the dodo and the carrier pigeon, but I know better. We are getting just as many good machinists as we ever did, but they are spread out thinner. If a shop has one crackerjack machinist, it thinks it is lucky; if it has two, it knows it is.

Most good machinists have served their time, but some others manage to do what is known as "steal the trade." These men, unless they have a tremendous aptitude and a winning disposition, pass through a terrible ordeal before they acquire enough knowledge of the business to have the other men accept them as machinists. I would not advise any one to try and "steal the trade," although I have known some excellent machinists who took this method, either by accident or design. One whom I know well, got into the business quite accidentally, and he got a lot of amusement out of his own ludicrous mistakes. He took delight in telling me of them long after he had become a finished machinist.

One morning, about seven o'clock, he joined a group of about twenty-five or thirty men outside the gate of a large machine shop. He was then about twenty-one or twenty-two years of age, and was looking for any kind of work that he could get. The employment agent singled him out of the crowd and said, "we need a lathe hand; you're a lathe hand, ain't you? Come on in. That's all we need this morning, men, come around tomorrow." He then sent Herman up to the small lathe department, and the boss put him to work. The first job he took on was a shaft about an inch in diameter and six or seven feet long, to be cut in two. The shaft was centered on one end, and as there was a chuck on the lathe, he chucked one end and put the center up to the other end. He then put the parting tool in, and started the lathe up. The lathe was speeded up pretty fast but that meant nothing to him. He jammed the tool into the job and started to cut.

He said that he noticed that all the men near him suddenly found important business somewhere else, and that they all seemed in a hurry to get to that business, but he steamed merrily along and cut that shaft off without a mishap. He said that someone told him afterward that they all expected to see that shaft wrap itself around his neck, but as he put it, "there is a special providence that watches over children and fools," and it was on the job that day. I asked him how he happened to chuck one end of the shaft, and he said he didn't know that the chuck was removable. He said also that he learned about a steady rest some six months afterward.

Herman told me of another fool stunt that he pulled off in the next shop he worked in. He hired out as a machinist, and the boss put him on a planer. He got along all right for a few days, then he got a job that was quite particular. After he had squared the job up and clamped it down, the boss told him that he didn't trust the square he had used and to get the new square from the crib, and check it. He went to the crib and asked for the new 12-in. square. The boy handed him a wooden box shaped like a square, with the square inside. He never suspected that there was a square inside of the box and thought it was rather strange that the boss wouldn't trust the steel square, even if it was old, rather than a wooden one, but who was he to question the boss' judgment, so he shoved the wooden box up to the job, found that it was O.K., and proceeded to finish the job. Fortunately, the job turned out all right so that there was no harm done, except to his feelings about a week later when he saw someone pull a fine new steel square out of that wooden box. Notwithstanding the inauspicious start, this man eventually became one of the best machinists I ever had the good fortune to meet. But he was one in a thousand.

Selecting and Hardening HIGH-SPEED STEEL—III

ALFRED HELLER
President,
Hercules Electric Steel Corporation

THE TWO preceding articles discussed respectively the hardening characteristics of five representative classes of high-speed steels and the toughness of these steels when subjected to a range of temperatures and periods of soaking. This last article of the series will develop the technique for tempering these steels and will give practical information on their selection for various uses.

In order to understand the changes in high-speed steel when tempered, it will be necessary to consider these changes in the light of the known characteristics of all steels. First, an allotropic change of the iron content occurs when the steel is heated through the critical temperature. The alpha iron changes to gamma iron, and a decided shrinkage occurs because gamma iron is more dense. Second, gamma iron dissolves carbon and, therefore, the carbides contained in the steel. In quenching steel, some of this gamma iron and some of the dissolved carbon are always retained after hardening. When steel is tempered, however, the residual dissolved carbon is gradually precipitated as a carbide, and the gamma iron converted to alpha iron, causing an increase in volume.

These two changes; namely, carbon precipitation and gamma iron conversion, are always accompanied by a more or less sudden change in the hardness of the steel. Therefore, a curve showing how hardness varies during tempering, when plotted against a curve showing growth, will show what is happening in the steel. Fig. 11 shows such a set of curves for a standard-tungsten high-speed steel (Steel No. 2). Six pieces measuring $\frac{5}{16}$x$\frac{5}{16}$x2 in. were hardened at 2,250 and 2,350 deg. F., respectively. These pieces were then surface ground. A salt bath was used in tempering up to 1,000 deg. F. Heating of the steel pieces between temperatures of 1,050 and 1,350 deg. F. was done in an atmosphere of illuminating gas to prevent scaling.

In tempering up to 600 deg. F., it was found that a decided shrinkage occurred in the steel, followed by carbon precipitation. Over this range hardness decreases slightly. Between 600 and 900 deg. F., there is little change in volume and practically no change in hardness. But, beginning at 900 deg. F., a decided increase in hardness becomes evident, which reaches a maximum at about 1,075 deg. F. For temperatures above 1,100 deg. F., the steel shows decided softening, becoming very pronounced at temperatures in excess of 1,200 deg. F. The growth curve shows that expansion begins at 1,000 deg. F. and is completed at 1,150 deg. F. This expansion is caused by gamma iron being converted into alpha iron.

The hardness change over the range 900 to 1,150 deg. F. is the most important change for high-speed steel, since practically all high-speed steel is drawn between 1,050 and 1,100 deg. F. An increase in the hardness at 900 deg. F. shows that some gamma iron is being converted at this comparatively low temperature. However, the growth curve shows no increase in volume up to 1,000 deg. F. It must be inferred, therefore, that over the range of 900 to 1,000 deg. F., the contraction due to carbon precipitation, which probably occurs simultaneously with the gamma-iron conversion, balances the expansion due to the latter change. However, at 1,000 deg. F., the gamma-iron conversion assumes such proportions that an expansion is evident. This continues until 1,150 deg. F. is reached. From this temperature up to 1,300 deg. F. there is no growth. Higher drawing temperatures than 1,300 deg. F. would cause a decided shrinkage until all carbon is out of solution.

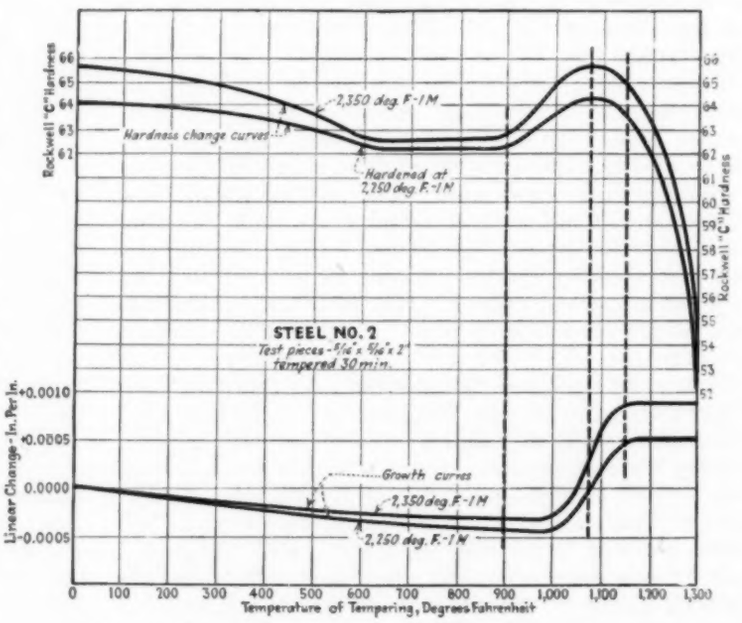


Fig. 11—Comparison is made of the volume changes and hardness changes of Steel No. 2 during tempering. Maximum hardness is achieved at 1,075 deg. F. with a growth of 0.0005 in. per in.

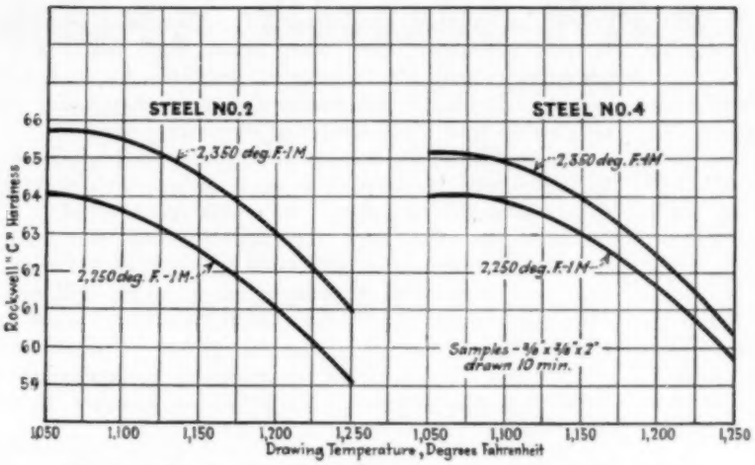


Fig. 12—This curve shows the effect of drawing the temper of high-speed steel beyond 1,050 deg. F. It also shows that cobalt high-speed steel has slightly greater heat-resisting properties than the regular tungsten high-speed steel

It is important to note that at 1,050 to 1,075 deg. F., when maximum hardness is attained in drawing high-speed steel, there is a large percentage of unconverted gamma iron retained in the steel. When the bulk of this gamma iron is broken up at 1,150 deg. F., the steel is softening quite rapidly. Apparently, therefore, a definite percentage of gamma iron is necessary to produce and retain maximum secondary hardening. However, it is quite essential that as much of this gamma iron as possible be converted to alpha iron, consistent with the production of maximum hardness. If this is not done, high-speed tools will be brittle and will not give maximum wear. Retention of gamma iron, and the attendant dissolved carbon, is a cause of weakness in high-speed steel.

The curves plotted show that the best results in tempering are obtained by heating high-speed steel tools to 1,050 or 1,075 deg. F., holding them for 30 min., and cooling either with the furnace or in still air. If it is not practicable to hold tools for this length of time, it will be found that fair results will be obtained by heating slowly to 1,100 deg. F., and allowing the tools to cool in still air. When extreme toughness is desired a slightly higher drawing temperature is recommended; namely, 1,150 deg. F. At this temperature most of the gamma iron has been converted to alpha iron and maximum toughness is obtained at a slight sacrifice in hardness. Fig. 12 shows the decrease in hardness by drawing at temperatures beyond 1,050 deg. F.

Although high-speed steel does not crack readily in hardening, occasional cracking does result with some of the heavier sections. It is thought best, in order to prevent cracking, to keep the tools from becoming colder than 400 deg. F. during the quench. Since 400 deg. is higher than the flash point of most quenching oils, it will be necessary to use an oil with a flash point of about 600 deg. F., or higher, or as a substitute to heat the quenching bath from 200 to 250 deg. F.

High-speed steel can also be hardened by simply cooling in still air. Small tools made of tungsten steel will become just as hard when cooled in still air as when quenched in oil. See Fig. 13. Large tools, however, will not become quite so hard, but the difference between oil quenching and air cooling will be only one or two Rockwell "C" numbers. Cobalt steels are more susceptible to air cooling than straight-tungsten steels, so that very little difference in hardness is noticeable between oil quenching and air cooling. When tools are likely to warp, a combination of air cooling and oil quenching can be used to advantage. In such cases, air cool to 1,500 deg. F. and then quench in oil. This applies to tungsten steels only.

When selecting high-speed steel, it will be found that, for the great majority of uses, a straight-tungsten, high-speed steel of the analyses similar to Steels Nos. 1 and 2 will be found satisfactory. Both steels are standard and can be obtained from stock. They are easily machined, and are usually free from seams as obtained from the mill. If properly hardened, these tungsten steels will not develop soft skin or show signs of brittleness. Cracking during hardening is less likely to happen to them than to a cobalt steel. When tools are subjetc to excessive strains, Steel No. 3 is sometimes employed, such as for punches, shear blades, and threading tools. Usually, there is very little mill stock available of this low-carbon steel, and generally the standard 0.70 carbon high-speed steel will answer the purpose just as well.

In some cases, cobalt steels have shown a marked superiority over tungsten steels, particularly for machining of hard alloys and scaly or sandy material. They also perform well in the fast cutting of alloy steels.

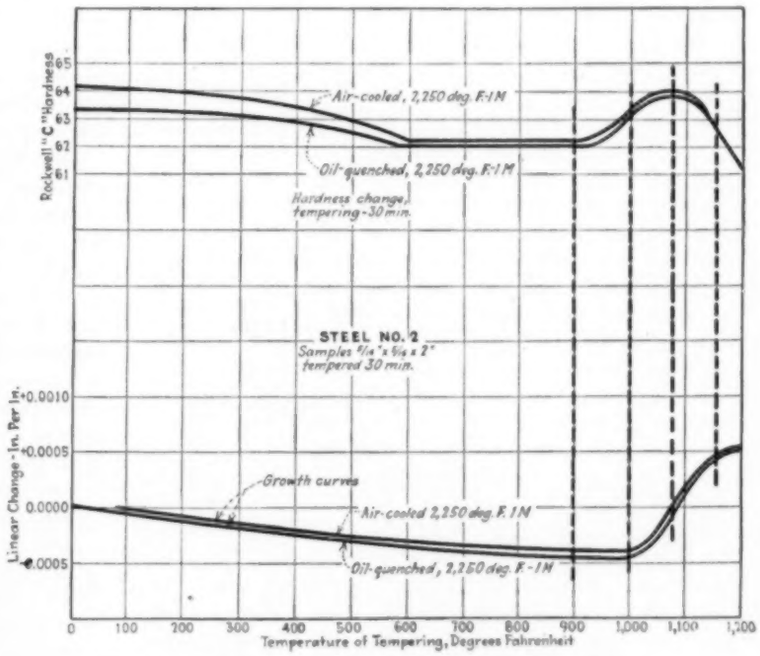

Air-cooled, 2,250 deg. F-1M
Oil-quenched, 2,250 deg. F-1M
Hardness change, tempering-30 min.
STEEL NO. 2
Samples ¾" x ⅝" x 2" tempered 30 min.
Growth curve
Air-cooled 2,250 deg. F. 1M
Oil-quenched, 2,250 deg. F-1M
Rockwell "C" Hardness
Linear Change - In. Per In.
Temperature of Tempering, Degrees Fahrenheit

Fig. 13—For practical purposes the same physical properties are developed in high-speed steel irrespective of being oil quenched or cooled in still air. This applies only to the smaller sizes

However, they are more likely to crack in hardening when oil quenched than tungsten steels, and have a greater tendency to develop a soft skin.

For certain tools it is necessary to pack harden in order to achieve great wear. Such tools are rotary files, blanking dies, and similar tools, which are often pack hardened for about three hours at 1,800 deg. F. No loss of size is experienced through the formation of scale, and the tools can be quenched in oil or cooled in still air. Air cooling will give a Rockwell hardness of C66 before the temper is drawn: whereas at 450 deg. F. it will give C64.5; at 600 deg. F., C64; and at 1,050 deg., C60. A hardness of Rockwell C62 cannot be filed. Dies made of pack-hardened high-speed steel, air cooled, change very little in hardening and give remarkable wear for the lighter kinds of press work. Although a steel containing a high percentage of carbon and chromium is used extensively for this purpose, high-speed steel is sometimes desirable because it machines more readily. After hardening it will retain a core much tougher than obtainable with pack-hardened chromium steel.

In conclusion, the treatment recommended applies only to high-speed steels of the same or approximately the same analysis as the five steels considered. The analyses described are representative of the leading brands of high-speed steel on the market, so that in nearly all cases the recommendations made will apply. However, steels with higher cobalt content and some foreign steels are now coming on the market. Consequently, to get best results it will be necessary to determine the hardening characteristics in a similar manner to that described in the second article of this series.

Redimensioning for the Jig Borer
Discussion

A. R. KLIGMAN
Designing Engineer, Kier Castype Corporation

THE articles on Redimensioning for the Jig Borer, *American Machinist*, page 231, Vol. 74, raise the question: How should a detail be dimensioned?

There are at least three angles to this question. Analysis of these may point out a satisfactory answer.

First, the part has to perform certain functions. It is up to the designer to decide what dimensional characteristics are essential for the part, and how great the variations can be without making it useless.

Second, for the toolmaker to be able to make a templet without any computation work, the dimensioning of all points on the drawing must preferably be made in decimals of an inch and from two reference lines at right angle. This assumes that only a few ordinarily used tools are available. The dimensions, preferably arranged in a neat way, such as are made use of in the illustrations of the articles, are sufficient for the toolmaker to scribe with the height gage two sets of lines, prick-punch proper intersections, swing arcs where necessary, and join the points with straight lines.

Third, when the part is actually produced and goes to inspector for approval the blue print accompanying it must point out to him, among other things, which elements are vital, and should be checked for correctness. A drawing similar to Fig. 3 or Fig. 5 would be bewildering to him. When the toolmaker was making his templet he could afford to use definite thousandths of an inch in scribing all his lines, whether they were important or not, because this is the most expeditious and economical method. But, in case of the inspector, only a smaller number of dimensions have to be checked, and these should be plainly pointed out to them.

The natural way then is to specify permissible limits of variations. But it is important to put them where they belong. Thus, in addition to dimensions locating all the points from two reference lines a number of supplementary dimensions are to be added. These and some of the other dimensions, taken from common reference lines, should be toleranced.

To illustrate, let us examine the part shown in Fig. 6. One notices that the holes arranged in sixes on circles are positioned from their respective central holes, the latter being positioned from common reference lines. This suggests the importance of hole-to-hole distance within each circle and the relatively smaller importance of cluster-to-cluster distance. If this is the case then the drawing of this part should have:

(1) Given dimensions locating each and every hole making up the clusters from the main reference lines, all without tolerances,

(2) Put limits on dimensions within the clusters and dimensions locating the central holes of the clusters.

I believe this would satisfy all three persons in question: the toolmaker would be able to scribe all his lines without practicing more arithmetic than is absolutely necessary; the inspector, after examining the drawing, would know exactly which elements of the parts should be checked. As for the designer, he would feel happy because he could not be blamed for "sidestepping responsibility" and "passing the burden" which is his onto some one else.

One might ask then: What about all those extra dimensions like oblique distances, angular values, etc.? Should they be left out of the drawing and lost? Would not this entail repetition of computations at some later time?

Most of these, especially the angular values, I venture to say are of no use to the diemaker, let alone the inspector. They are very important to the engineering department, from the viewpoint of design, possible changes in future, etc. And if they belong there and not to the detail they, and all the computations, should be entered in a special engineering record book.

■

In rebuilding a long-stroke, double-acting press it was found that, because of their length, the counterbalance springs required could not be made heavy enough to support the weight of the ram. By introducing two bell crank levers to reduce the travel of the spring one-half, much shorter and heavier counterbalance springs were used. The springs fully support the ram and prevent its dropping back on the operator's hand should a part fail.

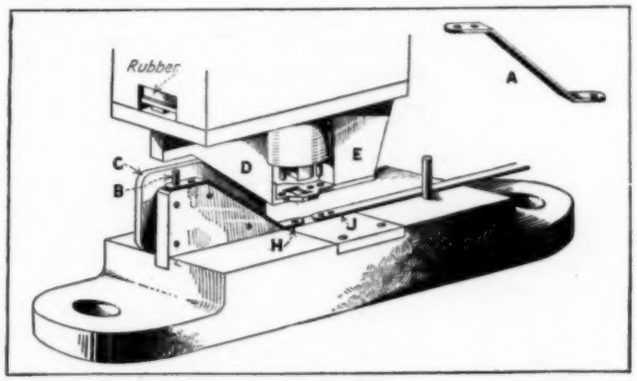
IDEAS FROM PRACTICAL MEN

Shearing, Piercing, and Bending Tools

CHARLES H. WILLEY
Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

COMBINATION tools are always interesting, for they always require creative effort in their design. In addition to saving time and labor costs, they often permit the use of less material. While the set of tools shown in the illustration was quite expensive to make, it allowed us to use coiled strip stock of the correct width, doing away with the necessity of a blanking die and the consequent trimmed waste.

The instrument bracket, or support, to be made is shown at *A*. The material is semi-hard brass and is fed



to the tools by pulling it through a set of straightening rolls to remove its tendency to coil. In operation, the first end of the first piece is sheared and punched, being fed forward between guide pins and plates. After the first end has been punched, the strip is carried forward and the hole punched in the end is placed over the pin *B*, which is in the top of the lower bending member. Thus the strip is held against movement while the bending is being done. Guide plates, one of which is shown in place at C, hold, or guide the strip. The front guide plate has been omitted from the illustration to show details.

When the ram descends, the sections *D* and *E* meet the part of the strip that is over the lower bending member, carrying it down over the bending member and holding it under pressure of the rubber in the upper part of the punch holder, which, as it compresses, permits further travel of the punches as the ram continues its downward movement. The punches pass through the stripper and pierce and part the strip, punching one hole at *H* and two at *J*. Since the rubber is compressed at this point of the action, it will be seen that as soon as the ram starts on the upward stroke the stripper is immediately forced off of the punches, leaving the piece on the die, from where it is flicked off by a tool operated by a concealed plunger in the lower bending block. Production is at the rate of 1,000 pieces per hour.

While the constructional details of the upper part of the punch section are not shown, it is sufficient to say that the punches are all set in a punch plate, and that the sliding sections are doweled for guidance. While the illustration shows the stripper down off of the punches, they are actually entered in it, the illustration being made to bring out the principles of operation.

Jig for Drilling Holes in Crossheads

CHARLES C. TOMNEY
Chief Tool Designer,
Brunswick-Kroeschell Company

The jig illustrated in Fig. 1 is for drilling holes in our compressor crossheads, one of which is shown in section in Fig. 2. The body of the jig is made of aluminum for lightness, as it has to be turned over for drilling the various holes. The crosshead fits in the hole *A*, and is located by the hollow plug *B* entering the wristpin hole through one of the holes in the side of the jig. A chamfer at the entering end of the plug permits easy alignment. For clearance for the drill and the chips when drilling the angular holes *E*, a slot is milled in the chamfered end of the plug.

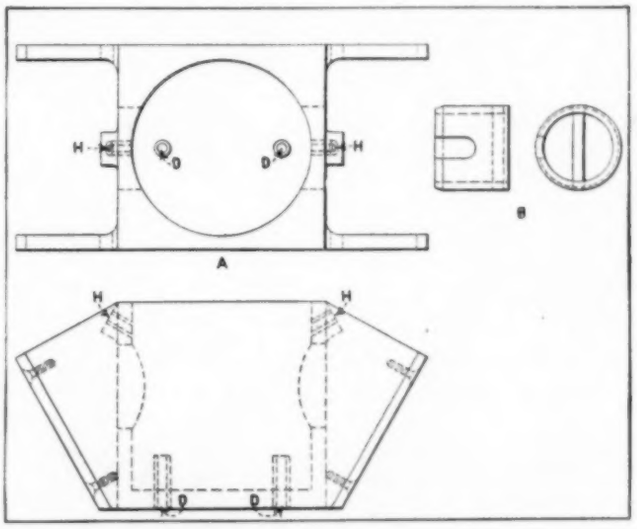


Fig. 1.

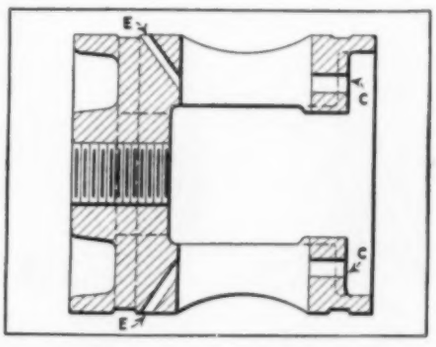


Fig. 2

Bushings *D* are for guiding the drill when drilling the holes *C*. These bushings are longer than is necessary because the jig is also used for drilling pistons of the same outside diameter but having a longer skirt. Bushings *H* are for guiding the drill when drilling the angular holes *E*. For this operation, the jig is alternately stood on the angular wings at the sides, each wing being at a right angle to the hole on the opposite side. Because of the softness of aluminum and its likelihood to pick up chips, the wings are shod with strips of steel.

■

Fixture for Slotting Toolposts

AVERY E. GRANVILLE

A Western shop using a limited number of toolposts has developed a device for milling the tool slots that is easily handled and turns out smooth, accurate work. At the same time, no expensive machine is tied up for this job. When the work has been finished, the fixture can be removed from the machine and stored until again needed. The fixture is shown in place on the table of a drill press in Fig. 1. The toolposts, which are of the usual shape, are turned from bar stock in a turret lathe, and the holes for the clamping screws are also drilled and tapped in that machine.

When ready for slotting, a toolpost is placed in the fixture, as shown below. It is slipped in from the left, the tapered end being held in the centering device illustrated. The other end is held by means of a sliding piece, which is locked by a lever nut. The centering device can be adjusted for different diameters and tapers by means of a taper wedge. This wedge also acts as a clamp, forcing the taper part of the toolpost down on a V-seat and locking it. The two cross-brackets serve to carry the upper and lower guide bushings and are adjustable up or down on their supporting posts. This adjustment takes care of toolposts of different diameters and enables the operator to bring both bushings close to the work, so as to reduce tool spring to the minimum.

After the toolpost has been locked in the fixture, cross-holes are drilled through it, using a drill slightly smaller than the milling cutter to follow. The slip bushing, shown lying in the oil pan, is used to guide the drill. After the cross-holes have been drilled, the drill and the drill bushing are removed, and both the upper and lower guide bushings for the milling cutter are put in place. The milling cutter is made from a flat-twisted, high-speed steel drill, the edges having been ground so as to give clearance and good cutting qualities, about the same as a helical cutter.

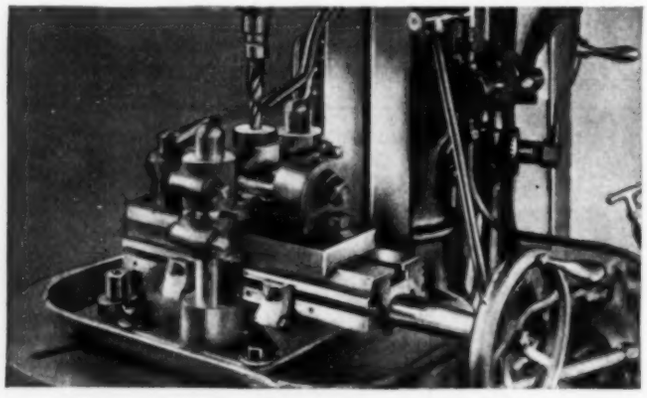


Fig. 1

In operation, the cutter is run down through the hole at one end of the slot until its lower end enters about an inch in the lower bushing.

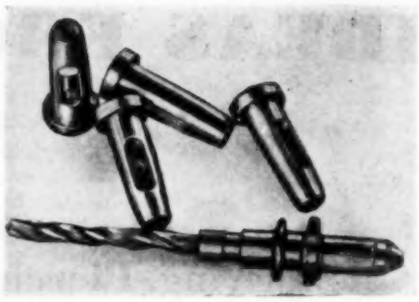


Fig. 2

This bushing steadies the lower end of the cutter and prevents it from springing during the cut. The work-carrying slide is then fed along by turning the handwheel at the right, carrying the work with it. Two stops limit the travel of the slide in each direction, controlling the length of the slot. In order to make everything as clear as is possible, some of the slotted toolposts and one of the milling cutters are shown in Fig. 2. The quick-change chuck makes the changing of the cutter or the drill a matter of seconds only.

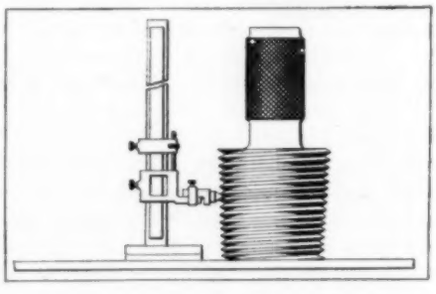
■

Measuring Pitch Diameters of Taper Threads

CHARLES KUGLER

In my experience as a tool inspector, I have sometimes found it necessary to determine pitch diameters at certain points of taper thread-gages by means of the three-wire system. Since I have failed to find anything published on the subject, I believe that others can profit by my experience.

To find the exact point of the thread to be measured, a height gage fitted with a cone point of the same angle as that of the thread, is used, as shown in the illustration. With the cone point so placed that its axis is horizontal and at the desired height, the gage is rotated until the cone point fits accurately in the thread. The position of this point of the thread is marked by placing a bit of prussian blue on the cone point and engaging the point with the thread.



The gage is then held in a suitable manner and one of the wires is placed in the thread at the marked point. The other two wires are placed in adjoining threads on the opposite side. Measurement is made over the wires by the micrometer in the usual manner. When there is proper contact between the micrometer and all three of the wires, the micrometer will not be perpendicular to the axis of the gage. Owing to its inclination, the measurement over the wires must be multiplied by the secant of half the included angle of the gage. A formula for finding the pitch diameter of any tapered thread, the thread being symmetrical in respect to a line perpen-

dicular to the axis, can be expressed by the following formulas:

$$E = M \sec Y + \frac{\cot A}{2N} - G\left(1 + \csc A + \frac{S^2}{2}\cos A \cot A\right)$$

In which E = Pitch diameter,
M = Measurement over the wires,
Y = One-half the included angle of the taper,
N = Number of threads per inch,
A = One-half the included angle of the thread,
G = Diameter of the wires, and
S = Tan of helix angle.

Neglecting the term involving the tangent of the helix angle, the pitch diameter of the Briggs standard pipe-thread can be expressed as follows:

$$E = 1.00048\,M + 0.86603\,P - 3G$$

In which the letters have the same meaning as those used in the first formula, and P equals the pitch of the thread.

[The author is interested in knowing how other toolmakers measure the pitch diameter of taper threads. Discussion on the matter will be welcomed.—Editor.]

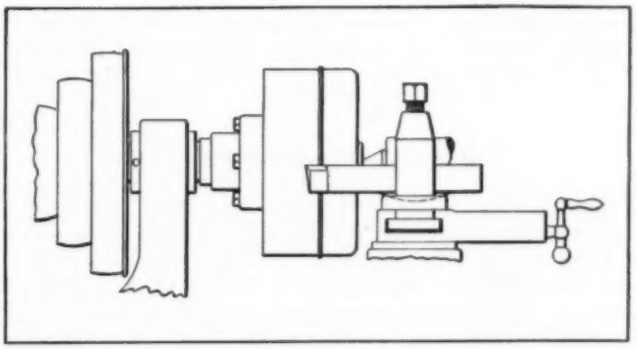
■

Experimental Blanks for Drawing
Discussion

HENRY W. BOEHLY
Machine Designer, Mergenthaler Linotype Company

In an article under the title given above, on page 439, Vol. 74, of the *American Machinist*, Charles H. Willey describes a method for cutting round disks for experimental purposes, producing very accurate results.

We made experimental blanks by a similar method in a plant where I was employed as machine designer some



years ago. However, instead of the castings for holding the blank, as described by Mr. Willey, we used wooden disks between which the rough blanks were held, as shown in the illustration. The inner disk was attached by lag screws to a flange screwed onto the nose of the spindle. The outer disk was held against the rough blank by the pressure of the tail center. A metal plate, properly centered and countersunk, was attached to the outer disk to prevent the center from unduly wearing away the wood.

A set of such disks can be made in much less time than it would take to finish the cast-iron ones described by Mr. Willey. When extreme accuracy is not required, experimental blanks can be cut on circular shears without provision for revolving them. A circle of the required diameter is scribed on the sheet by means of compasses, the sheet being revolved by hand. With a little skill, blanks can be cut close enough to size to be satisfactory for most purposes.

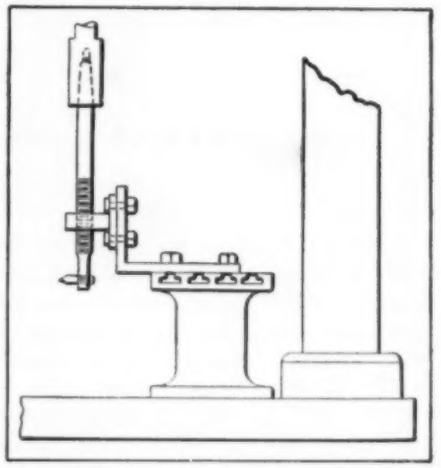
■

Threading in a Radial Drill

ED. C. RENDLER
Machine Shop Foreman

The illustration shows an arrangement that was devised to eliminate the necessity for making a special tap of large diameter to rethread a hole from which the threads had been stripped.

A bar having a tang to fit the spindle of the machine, and provided with a slot for holding a cutter, was threaded, the lead of the thread being the same as that to be chased in the hole. A nut to fit the thread on the bar was attached to an angle plate mounted on the independent table of the radial drill. By this device, with a cutter in the bar, the radial drill was temporarily converted into a lathe, the bar acting both as a lead screw and a chasing bar. The reversing attachment, with which most radial drills are equipped, makes the threading a simple job.



■

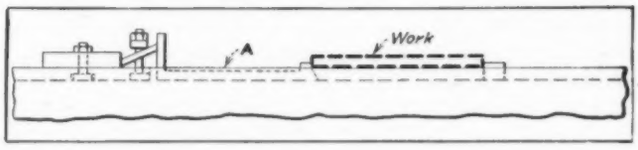
Fixture for Holding Thin Work
Discussion

W. E. WARNER
Garden City, England

I was much interested in the discussion of the article under the title given above, by C. A. Coppack, on page 66, Vol. 74, of the *American Machinist*. I have often had to undertake such work, so perhaps my method may be of interest to others. Thin work can be classed under two heads: Work that is too thin to permit the use of clamps and straps and work that will permit the use of very low clamps and straps.

In dealing with thin work of the first class, my method is to place it on the machine table, mark around the edges with chalk, remove the work and clean around the chalk marks with abrasive cloth. The work is then replaced and the table is polished for a width of about an inch around it. Melted resin is then run around the edges of the work. The resin will adhere to the cleaned surfaces, and when set will hold the work fimly enough for light cuts to be taken.

For work of the second class, I use the method shown



in the illustration. The piece *A* rests in one of the T-slots in the table, the small projection at the right bearing against the work. Pressure is put upon piece *A* by the angle clamp bearing against both it and the stop at the left. The work is prevented from moving by the stop at the right. In operation, the work is butted against two or more stops, then two of the pieces *A* are put in adjoining T-slots. Two of the angle clamps and two of the stops at the left are applied. Sufficient pressure is put upon the angle clamps to hold the work firmly.

I have found this device to be very useful for holding work where lengthwise space was limited, since the pieces *A* can be made in length to suit all conditions.

■

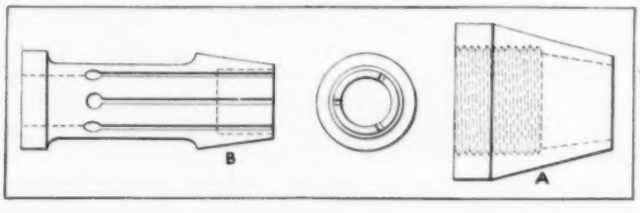
Internal Chuck—*Discussion*

O. D. Bradshaw
St. Johns, N. B., Canada

In an article under the title given above, on page 292, Vol. 74, of the *American Machinist*, Ralph W. Dicely describes a chuck for holding parts for a second operation. The chuck illustrated herewith would, I think, be better adapted for the job than would the one described by Mr. Dicely. Its advantages over his chuck are: (1) greater bearing on the holding surfaces, permitting heavier feeds and greater production, and (2) less error in the work, since the work will run more truly.

Referring to the illustration, at *A* is a nose piece threaded to fit the machine spindle, the plain part of the hole being tapered toward the front. At *B* is a spring collet, the taper on the outer end being the same as that in the nose piece, while the inner end is a sliding fit in the collet tube. The diameter of the hole in the front is the same as that of the outside of the work. Since the hole through the collet is smaller in diameter than the hole in front, a shoulder is formed for the work to rest against. Three radial slots are milled in the collet, terminating in holes in the rear but not coming quite through at the front. After hardening and tempering the collet, the slots are cut through at the front by grinding away the unmilled portions.

The collet is forced forward by means of a bushing in the collet tube, gripping the work by contraction caused by the tapered end of the collet being forced into the taper hole in the nose piece. By the use of this chuck, nearly all of the outside area of the work can be utilized as a gripping surface. A chuck of this type has a more even holding contact on the work than has an expanding chuck, especially one in which the expanding member has but one slot.



SEEN AND HEARD

●

How Shall We Standardize Machines?

ALMOST every shop man agrees that it would be helpful if machine tool sizes were standardized in a reasonable manner. Some machines have arbitrary numbers which tell the builder all about them but which are Greek to the user. Lathe and planer dimensions are fairly satisfactory except when too much "oversize" creeps in; but many machine designations tell the prospective buyer very little.

Standardized designations are in the air. Shall it be by the maximum dimensions of the work that can be machined or by the travel of tool or work holding elements in various directions? And should the rate of production or the accuracy possible be standardized as factors of the machines?

Cheaper 'n Better

A PROMINENT machine tool designer recently told us that he never uses a plain bearing today where a ball bearing is at all suited to the particular application in question. The reason, he said, is that the ball bearing is not only cheaper, all factors considered, but also is more satisfactory. One factor of importance is that the hole in which the ball bearing fits can be accurately bored when the frame is being machined and no reaming has to be done once the bearing is in place, as is usually the case with a plain bearing if exact alignment is a factor.

In addition, ball bearings take considerable end thrust, are easy to fasten in place, and to lubricate. They also can be made to position the shaft accurately axially as well as radially. Moreover, when well made and adequately proportioned to the load imposed, ball bearings rarely show material wear during the life of the machine.

Materials Handling Plus!

TRADE ADVISORS tell some fascinating tales of the way foreign marketing is done on economic lines—how Mexican beans take the regular steamer transit to Spain and from there are distributed to the world, or how rugs made in Philadelphia are shipped first to Arabian ports so as to be "imported" authentically. But there are also some things worth noting in the newer aspects of everyday machine shop economics. Lately, even shops with good iron foundries have found it economic to buy large castings from foundries located near the source of the iron ore, and in most cases where the casting is very weighty they order the rough machine work to be done at the source so as to avoid shipping a mass of iron that might show flaws after the cuts are taken.

More recently, at least one large company in the East has gone even further and ordered heavy steel castings to be machined at the source and shipped directly to the customer where fitting and assembling is done. On heavy work it saves both transportation costs and extra handling charges, and also saves shop room. It is applying scientific materials handling beyond the four walls of the shop!

Don'ts for Estimators

Don't allow buyers' high-pressure tactics and unreasonable demands to stunt your reasoning power. Estimate carefully.

Don't forget that in hard times business is scarce and it is a buyers market, meaning that there is little or no chance for profit.

Don't forget that in good times capable help is scarce and that the help shares heavily in the profit.

Don't forget that what profit is left must carry the firm through hard times as well as good times.

Don't forget to add a proper profit; that is what the firm is in business for.

Don't waste time and money on a customer who will not allow you a profit. Cut him out entirely.

Don't forget that the firm is better off without business from bargain hunters and shoppers, as their business usually results in loss.

Don't forget that it takes time and costs money to estimate work; the average for the year amounts to 2% of sales.

Don't forget that the time and expense involved in estimating thoroughly and accurately is your best insurance policy against loss.

Don't forget that by guessing wild on work you will pay a heavy premium. Your average loss by so doing by the year will be 15%.

Don't forget to consider and allow for designing time; the average for the year amounts to 10%.

Don't forget that the incompetent workman who misrepresents himself is a total loss.

Don't forget that there are many of this kind employed throughout the year.

Don't forget that the spoilage of material and the loss in time averaged over the year amounts to 10%.

Don't forget to allow for hardening and heat-treating costs.

Don't forget that punches and dies distort and crack, resulting in an average loss of 3% over the year.

Don't forget that hardened parts when distorted must be lapped, ground, or reworked, an average cost of 2% over the year.

Don't omit the cost of screws, springs, dowel pins, bushings, or patterns. These cost money.

Don't forget that workmen everywhere make mistakes; the average cost for the year amounts to 10%.

Don't forget the wear and breakage on cutting tools; it amounts to an average of 20%.

Don't forget that saw cuts and wasted ends of material are scrap. The average for the year amounts to 5%.

Don't forget that some firms fail and don't pay their bills. The average for the year amounts to 3%.

Don't forget that machinery wears out and loses value fast.

Don't forget that if the company cannot make a profit you will get nowhere.

Don't expect to get every job you bid on. A lot of business is not worth having.

Don't forget that the other fellow has the same problems and experiences, and that he is no fool.

Don't forget that the job shop trains and supplies the mechanics who later find their way to big shops.

Don't forget that it costs your firm a lot of money each year to train these men and that your customer should pay his proportion of this expense.

Don't forget that your only chance to get anything out of the tool or machine which you build for the customer is when you sell it. You get your profit then or never.

Dn't forget that your customer will profit continually by the savings produced by such a tool or machine.

Don't forget that according to government reports there is not so much special tool and machine business to be had that the job shop is justified in digesting it at too rapid a rate nor in doing such work for nothing.

Don't forget that unexpected contingencies arise in business, the cash for which must come out of the profit.

Don't forget that it takes a lot of money to run the business throughout periods of depression.

Don't forget that in times of depression your overhead may run as high as 300% and in good times never less than 90%. The average over 10 years will amount to 100%.

Don't forget that prosperity is always followed by depression in the ratio of 2½ to 1.

Don't forget above all things to demand a profit; it is the life's blood of business. You cannot continue without it.

Don't think you have your competitors on the run. Your pipe may go out.

Don't ruin the industry by cut-throat tactics. Nobody has started a war.

Don't be a professional low bidder. It is foolish, dangerous, and cowardly.

Don't forget that all of your competitors can do the same thing if they want to, but have better sense.

Abstracted with permission from the reverse of the uniform estimate sheet recently copyrighted by the American Machinery & Tools Institute, 40 North Wells St., Chicago

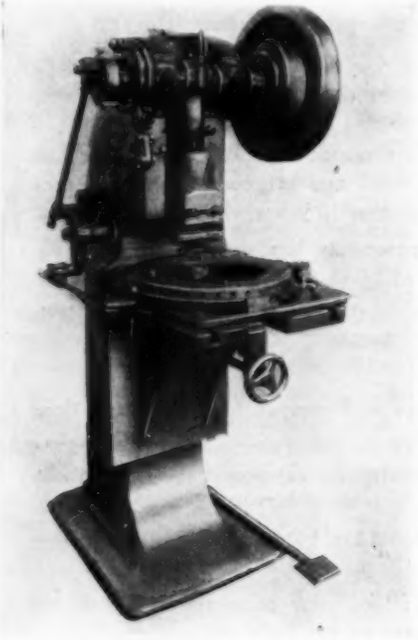
© American Machinist

SHOP EQUIPMENT NEWS

"V&O" No. 41 N High-Speed Notching Press

Primarily designed for notching electric motor laminations, but applicable to other work such as circular saws and bearing separators, a No. 41 N high-speed notching press has been developed by the V & O Press Company, Hudson, N. Y. Attachments are provided for both internal, or stator, notching and external, or rotor, notching. The machine is capable of maintaining tolerances as close as 0.002 in. when operating at speeds of 450 to 600 strokes per minute.

The press is of the pedestal type, the body and legs being integral to give rigidity. Journal bearings are of the overhanging type, carrying the thrust directly to the press frame. The shaft has an eccentric throw, being more rigid and affording a larger bearing surface than can be secured with the usual crankshaft. All main bearings are bronze bushed.



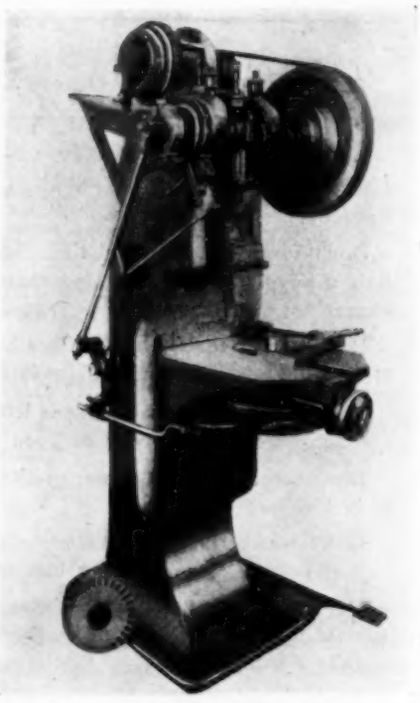
Internal notching mechanism applied to the No. 41 press. Disks from 4 to 15½ in. and with from 12 to 130 notches can be handled

To minimize shock during engagement at high speeds, an automotive-type, multiple-disk friction clutch is used with the fully releasable brake. This type of brake relieves the press of all friction load when in operation, and is so arranged as to stop the press at the top of the stroke at the instant the clutch is released. The web-type flywheel is machined to attain balance. Adequate lubrication facilities are provided for high speed operation.

The slide is extra long and runs in ways of equal length. Adjustment is made by a single, loose gib and one set of adjusting screws to secure precision of the slide travel and accuracy of the punch and die registration. The indexing mechanism is actuated by a driving crank on the press shaft, and, through a series of connections and a bell crank, a reciprocating motion is delivered to the driving lever. All connections are mounted on ball bearings to reduce friction.

For internal or stator notching, the indexing attachment consists of a circular base attached to the press bed, the outer circumference of which is machined, and to which is fitted the friction ring. The upper edge of the friction ring is flanged to permit the index ring to be attached with screws. The work-holding plate is secured to the upper surface of the index ring, and the work to be notched is held by dowels or spring clips or a combination of both.

Motion is applied to the work by means of driving jaws actuated by the reciprocating driving lever. The driving jaws are essentially a split ring lined with woven asbestos and grip the friction ring. With the forward stroke of the driving lever, the jaws move the index plate around and slightly past the point of engagement with the index pawl, which automatically engages the notch in the index ring. The return stroke of the driving lever carries the driving jaws back and seats the pawl firmly in the notch. At this point, a slipping action begins, the driving jaws sliding on the friction ring to allow the driving lever to complete its return stroke, and, at the same time, holding motionless the index ring and the work. While the work is thus held, the press slide descends, after which the process is repeated. An automatic throwout is provided to disengage the clutch when the work has been completely notched.



The external notching attachment is mounted below the table, the worktable being driven by the spindle protruding through the table

Means are provided in the press to secure the proper pressure of the driving jaws on the friction ring and to compensate for wear. Index rings and work-holders are both quickly interchangeable, and graduations at the front of the attachment base and on the driving crank make possible rapid changes from one number or style of notching to another. In and out adjustment of the attachment is made by means of a handwheel at the front.

For external, or rotor, notching, the driving jaws, friction ring, and index ring are placed on the under-

side of the table and the work holder on the upper side, the work holder being driven by a spindle passing through the table. For external notching, the disk to be notched is usually keywayed to facilitate driving. The press with external, or rotor, notching mechanism will notch disks having outside diameters ranging from 3½ to 18 in., with a minimum of 12 notches and a maximum of 96 notches. The internal mechanism is made to handle disks from 4 to 15½ in. in diameter, with a minimum of 12 and a maximum of 132 notches on the circumference.

The company is also prepared to furnish equipment for notching stator and rotor blanks up to 72 in. in diameter.

American 42-In. x 80-Ft. Double-End Lathe

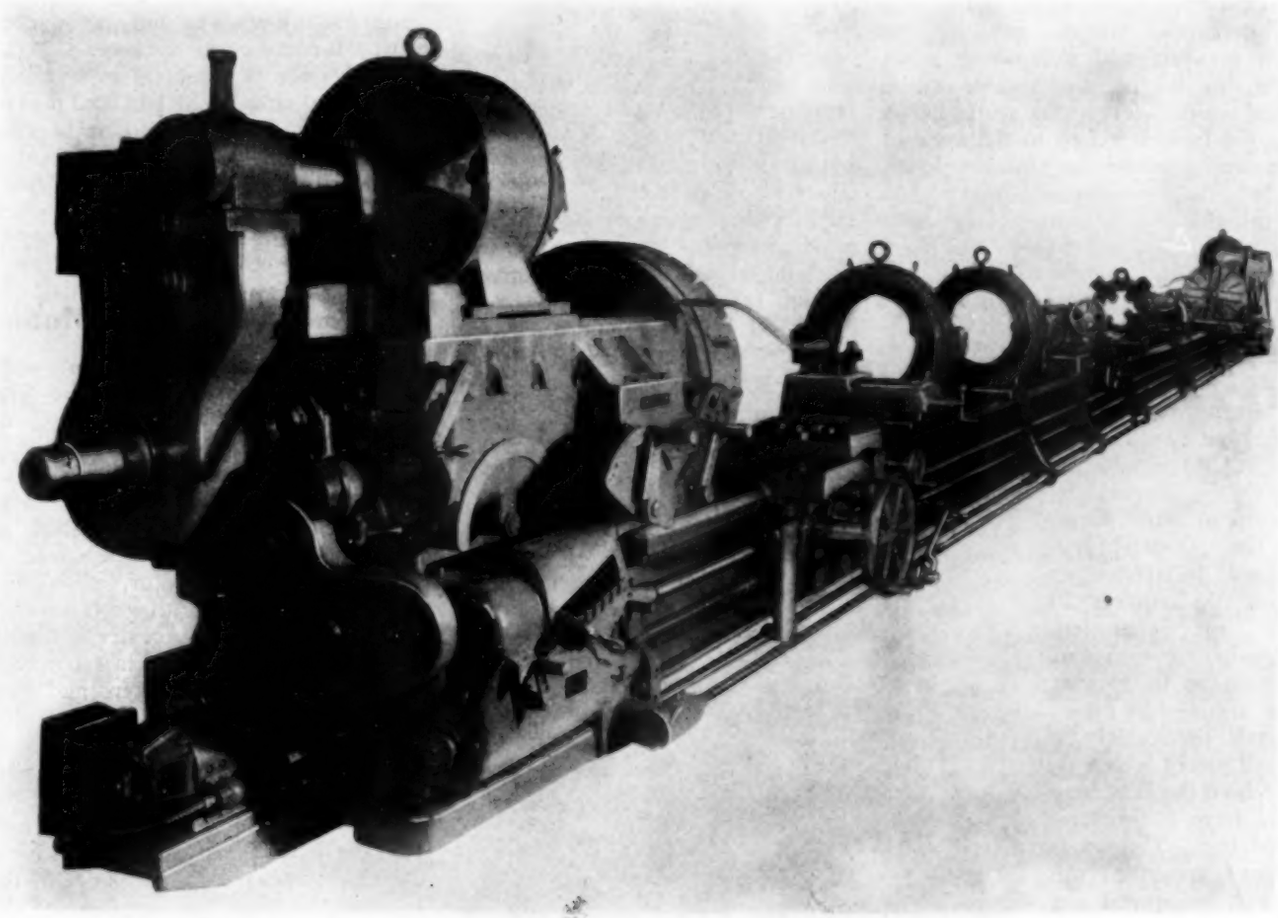
A double-end 42-in. x 80-ft. lathe has been built for the United States Navy Yard at Bremerton, Washington, by the American Tool Works, Cincinnati, Ohio. This lathe provides capacity for occasional machining of propeller shafts up to 60 ft. in length. Only for a small percentage of the time, however, will the lathe be used on propeller shaft work. In order to make use of the long bed, a complete set of elements is mounted on the tailstock end to make another complete lathe. As a consequence, this machine is in reality two complete lathes built on one bed. It may be used as one lathe, however, when the maximum center distance of 61 ft. is required. In this event the right-hand carriage and tailstock are moved to the extreme positions at the right-hand end of the bed. The right-hand head is then out of commission, except for chucking work requiring only a very limited movement of the carriage.

When this lathe is not required for the maximum center distance capacity, the headstock carriage, tailstock, feed and screw cutting mechanism and carriage power traverse of each lathe operate independently; in other words, two separate and distinct 42-in. lathes are then provided.

Each carriage is complete with taper attachment, power angular feed to the compound rest, and all other standard equipment. Each carriage is also provided with a rapid power traverse mechanism controlled at the apron and driven by a separate motor located at the ends of the bed.

Each head is of the internal-geared, face-plate-driven type. Eighteen mechanical changes of speed are provided, twelve of which are transmitted through the face-plate drive. Each head is driven by a 30-hp. motor, having a speed range of 500 to 1,500 r.p.m. The variation of the motor speeds is accomplished at each carriage by the handwheel at the right-hand end of the apron. This control enables instantaneous variation of the spindle speed within the 3 to 1 range of the motor, for each of 18 mechanical speed changes.

The weight of this double-end lathe, complete with all equipment, is approximately 100,000 lb.



A center distance of 61 ft. is available on this American 42-In.x80-Ft. Lathe when propeller shafts are to be machined, or two 42-in. lathes are available because the head stocks, carriages, tailstocks and feed and traverse mechanisms are furnished in duplicate

Schuler Type PW 300- and 500-Ton Forging Presses

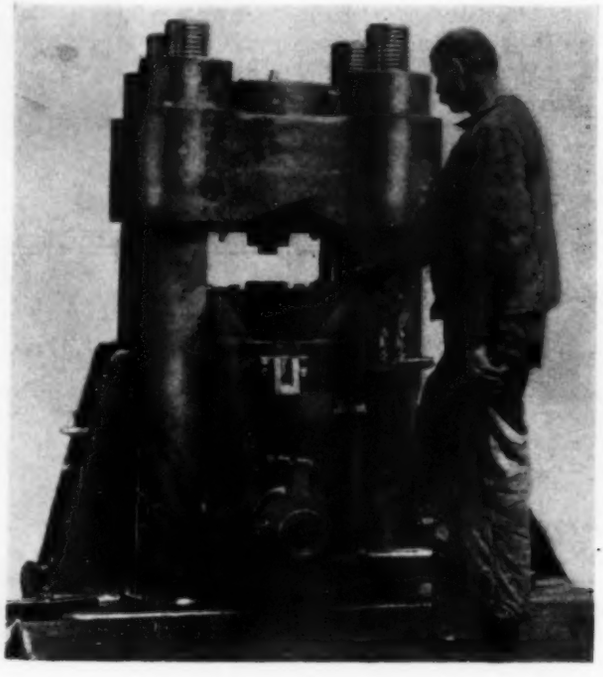
Low-headroom forging presses in two capacities have been placed on the market by J. I. Bernitz, 47 West St., New York, N. Y., and 11 Wellington St., E. Toronto 2, Canada. These presses are built by the Schuler Works, Germany, and make use of the principle of the Funk's patent. They are designed for hot forging ferrous or non-ferrous metals and alloys, but can also be used for cold pressing or other stamping work requiring a powerful pressure. The capacities are 300 and 500 tons, and the height above the floor is less than 7 ft. for both presses.

Movement of the forging dies can be predetermined and uniformly maintained during long periods of operation. Power from the underneath shaft is directly transmitted by a cylindrically mounted barrel to pillow blocks, thereby reducing the unit pressure and minimizing wear. The shut height is adjustable within wide limits. When dies are to be set up, the table is raised to the apex of the stroke while the nuts are loose. As the table goes up, the crown plate is raised by the two dies whose striking surfaces meet. Shims, which are supplied with each machine, are placed between the tops of the columns and bottom of the crown plate, and the nuts pulled tight. This arrangement shortens the time required for setting up dies. The press is started by means of a foot lever.

The 500-ton press runs at 48 strokes per min. and requires 20 hp. for operation. Speedy operation is of advantage in forging the non-ferrous metals, particularly on small pieces which do not hold the heat long and have to be handled fast. The maximum pressure can either be spread out over a long working stroke, or the press can deliver this pressure on a very short stroke only, as double gearing is provided. Because of these features, forgings of 3 oz. in weight can be made economically.

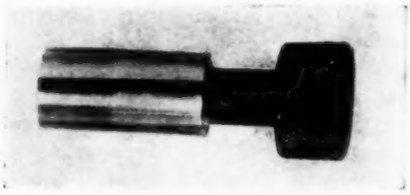
SPECIFICATIONS

Type	300 Ton	500 Ton
Stroke, in.	5½	5½
Clamping area on crown, diameter, in.	19½	25½
Clamping area on bed, diameter, in.	19½	22
Distance from moving bed to crown, in.	13½–19½	14⅞–21
Distance between housings at front, in.	18½	20½
Strokes per min.	48	40–48
Floor space, in.	6′ x 6′ 2″	6′ 7″ x 6′ 8″
Height above floor	6′ 3″	6′ 9″
Depth below floor	2′ 5½″	2′ 9½″
Power required, hp.	12	20
Weight, lb.	24,500	31,000



Van Keuren Utility Plug Gage

A combination straight and taper plug gage for measuring holes during lapping, grinding, or boring has been developed by The Van Keuren Company, 12 Copeland St., Watertown, Mass. The essential feature of this gage is that a taper of 0.010 in. in a ½-in. length is ground on the entering end of the plug, the remaining portion being precision lapped to the desired size of the hole. The distance that the plug enters indicates how much stock remains in the hole and just how much of a cut is required to bring the hole to finish size. If the plug just enters, there is 0.010 in. to be removed. If it enters to a point half-way up on the taper, the required stock removal is 0.005 in.; three-quarters of the way, 0.0025 in. The distance on the taper may be measured with an inch scale divided in 20ths, each 20th corresponding to an increase of 0.001 in. on the taper portion. A short knurled grip is provided rather than the long standard gage handle, so that the plug may be used while the work is in the machine and without moving the cutting tool away for any great distance.



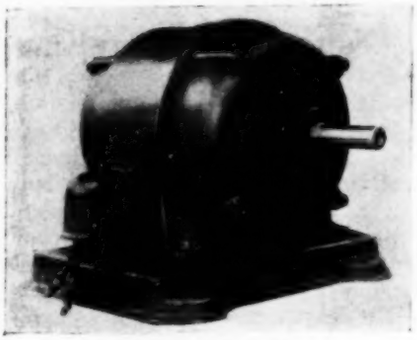
Van Keuren Utility Plug Gage which is tapered on the front

The gage is available in standard fractional sizes up to 1 in. and also in special sizes. If desired, it may be used as the "Go" member in the standard American gage design handles with a "Not Go" unit on the opposite end.

"Ideal" Drip-Proof Motor

An addition to the line of unit-type motors, manufactured by The Ideal Electric & Manufacturing Company, Mansfield, Ohio, is the drip-proof motor, which is protected against water or other liquids dripping on it or being splashed in through the ends. When water is thrown into the motor, it is discharged immediately through the vent at the bottom of the center inclosing jacket. Air circulation is from both ends toward the center and out through this vent. Large shrouded fans located just inside the end brackets produce the action which discharges the water. These fans throw the water against the inside surface of the bearing bracket. From here, the water runs down the inside of the bearing brackets and out through the center bottom vent without coming in contact with the windings.

The insulation is such that an occa-



"Ideal" Drip-Proof Motor

sional wetting will not have any serious effect. The strong blast of air is sufficient to evaporate any water that may reach the windings.

The outer surfaces of the Ideal drip-proof motor are such that water dripping from above cannot enter the motor. The end bearing brackets are so shaped that water dripping on them travels around the end and to the base without entering the motor.

Landis 8⅝-In. Pipe-Threading and Cutting-Off Machine with Air-Operated Chucks

The Landis Machine Company, Waynesboro, Pa., is offering an 8⅝-in. pipe threading and cutting-off machine equipped with air-operated chucks. These chucks insure a powerful grip and elimination of any tendency of the pipe to slip during the threading operation. The attachment is controlled by a four-way valve, which returns automatically to the neutral position when the operator removes his hand from the control.

"Red Ring" Gear Tooth Lapping Machine

For lapping automobile-transmission gears of the spiral spur type, the National Broach & Machine Company, Shoemaker & St. Jean, Detroit, Mich., is offering the "Red Ring" Model GLB lapping machine. This machine is capable of lapping both spur and spiral gears. Because the axes of the gear and the lap are crossed at a considerable angle, there is a definite cross-sliding action between the lap and the gear teeth at

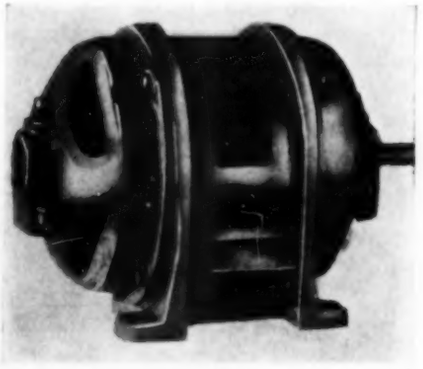
all points of contact. This avoids the irregular shape caused by lapping two similar gears. Well-cut and carefully heat-treated gears can be lapped in 3 min. More irregular gears require 5 or 6 min. With carefully made gears, the laps will give approximately 400 gears for each cutting, and provision is made for two recuts. The operator can run from three to four machines.

Wear of the lap is compensated for by adjustment of the angle of contact. This adjustment is controlled by means of a special spiral-angle checking device, which is calibrated to give exact adjustment of the machine for any given error in spiral angle that may be caused by wear.

Maximum capacity of the Model GLB is 7 in. outside diameter, 5 D.P., 1½ in. width of face, and 12 in. between centers. Maximum capacity of Model GLE is 15 in. outside diameter, 4 D.P., 5 in. width of face, and 18 in. between centers.

Westinghouse W-Frame, Type CS, Squirrel-Cage Induction Motor

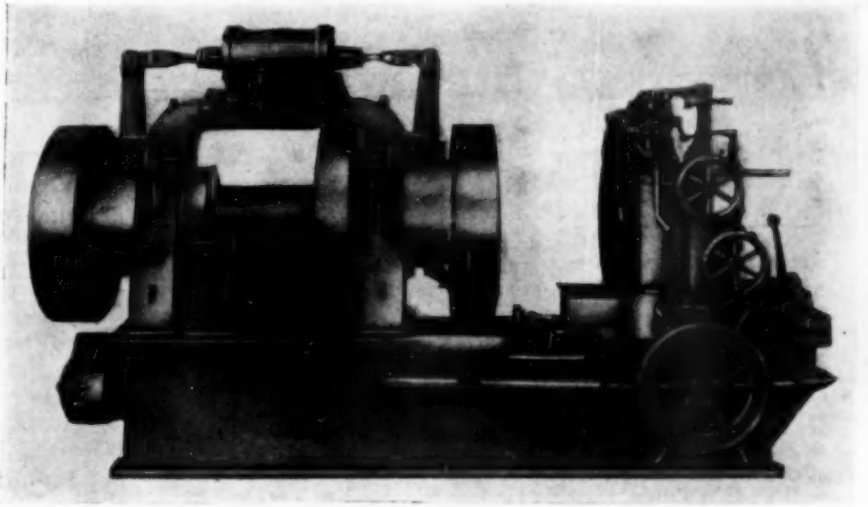
In the design of the W-frame, Type CS, squirrel-cage, induction motor, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has incorporated an innovation in motor design: making the different parts of the motor as



entirely separate units. Thus, the company has only to keep the number of standardized parts in stock to be able to build, on short notice, a motor for a specific application. The design makes maintenance simpler and less expensive.

In the W-frame motor, the stator core containing its winding is pressed into the motor frame. When it becomes necessary to replace the damaged winding, the old core and its winding is pressed out as a unit, and a new "pre-wound" core is pressed in. The entire operation can usually be performed in less than an hour.

Like the stator core and its wind-



ing, the rotor is a complete separate unit, and both the rotor and the stator core and their windings can be supplied as such for built-in motor or repair purposes. This feature makes it possible to vary the electrical characteristics, using the same set of mechanical parts.

The separate-frame construction makes it possible to supply any one of a number of different types of frames to meet the needs of the customer. The brackets are bolted to the frame with a ring-groove fit that automatically and permanently sets the air gap and aligns the bearings.

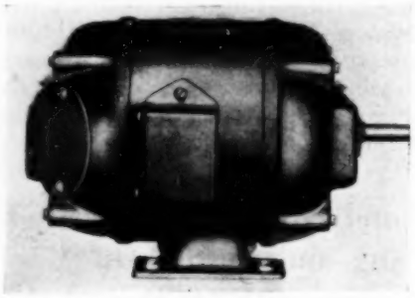
"Economy" ½- and ¾-In. Automatic Pointing Machines

Two automatic pointing machines of ½- and ¾-in. capacity respectively have been placed on the market by The Economy Engineering Company, Willoughby, Ohio. The Type B ½-in. machine will point bolts and capscrews of $\frac{3}{16}$ to ½ in. in diameter and any length from ¾ to 4 in. Operation of the machine is fully automatic, and the improved mechanism insures uninterrupted flow of pieces from the hopper to the roulette. The blank is gripped at the pointing station, where the pointing head comes forward, automatically pointing or chamfering the piece, after which it is dropped into the receptacle. The pieces are delivered at the rate of 2,000 to 3,000 per hour, depending on the size. One operator attends five machines. Either belt or motor drive can be furnished. The net weight of the machine is 2,000 lb.

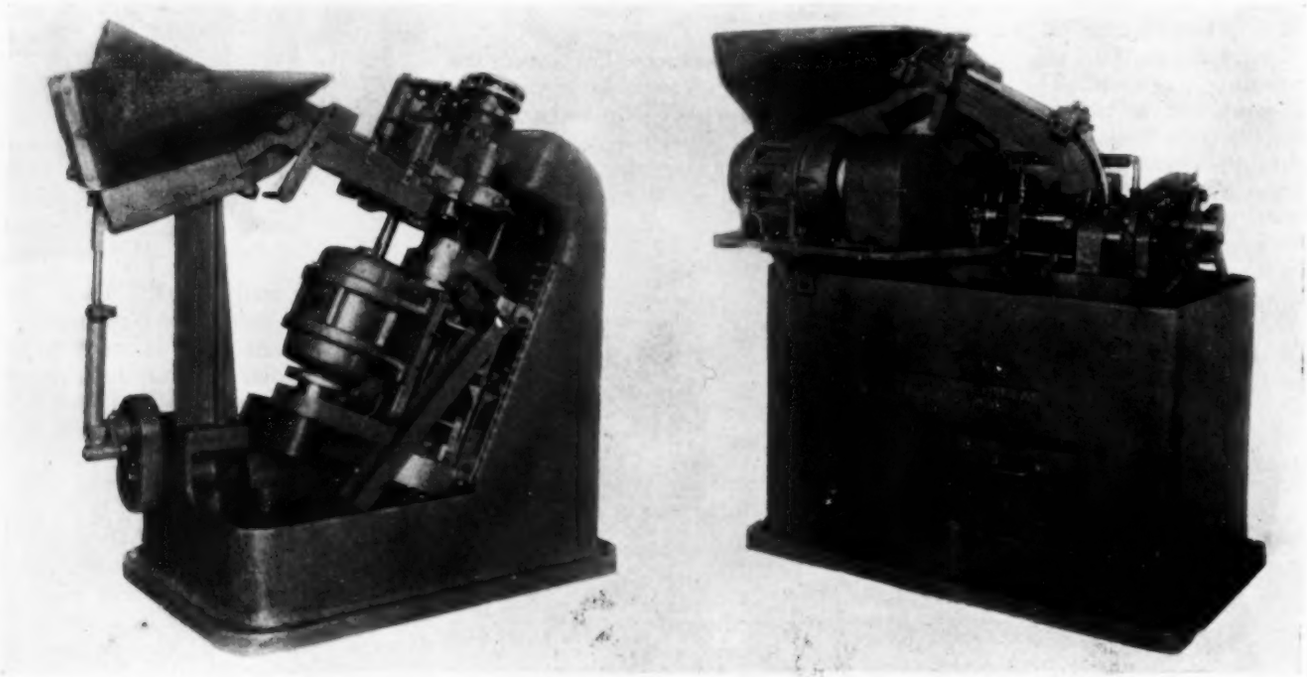
The Type BA ¾-in. machine is of such design that the roulette and pointing spindle are on the same angle as the hopper chute to eliminate lost motion and facilitate feeding of blanks. Production rates of 1,800 to 3,500 pointed pieces per hour can be obtained, depending upon the size and material. Bolts or capscrews from ¼ to ¾ in. in diameter and from 1 to 6 in. in length are handled. The pointing spindle is mounted on ball bearings, the other bearings being of bronze. A handwheel at the back of the machine moves the entire slide and makes possible rapid adjustment. A handwheel is also provided for turning the machine over by hand. The net weight is 3,250 lb.

Century Fractional-Hp. Motors

Interchangeable mounting dimensions are now featured in the line of fractional-horsepower motors built by the Century Electric Company, St. Louis, Mo. These motors include the following types: single-phase, repulsion-start, induction type; split-phase, single-phase type; and squirrel-cage, induction three-phase type, and the d.c. type. The bearing brackets offer protection against falling objects, dirt, and dripping water. The motors have rolled steel frames and welded steel feet, the latter slotted for belt adjustment. Bearings are machined from phosphor-bronze castings and equipped with "Century" wool-yarn system of lubrication.

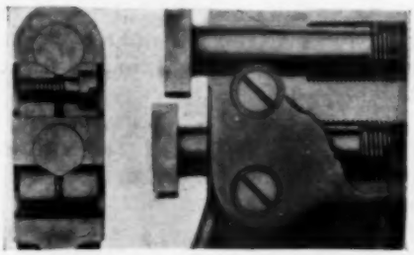


These interchangeable, fractional-horsepower motors are made in 60-,

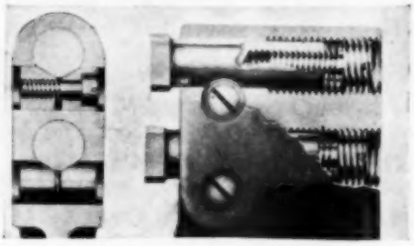


Left—"Economy" Type B ½-In. Automatic Pointing Machine for lengths from ¼ to 4 in. Right—Type BA ¾-In. Pointing Machine for lengths from 1 to 6 in.

50- and 25-cycle models. The 60-cycle motors are built in 1/6-, ¼-, and ½-hp. sizes in four frame styles; the 50-cycle motors in 1/6- and ¼-hp. sizes, and the 25-cycle motors in 1/6-hp. sizes.



Anvils and adjustable lock for Models A and B Snap Gages

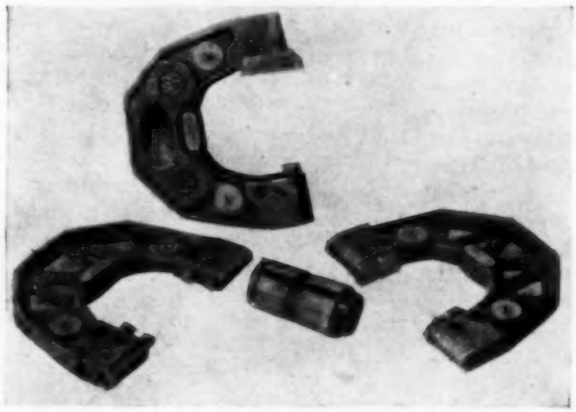


Same construction for Model C

Pratt & Whitney Types A, B, and C Adjustable-Limit Snap Gages

Three styles of snap gages employing "Trusform" construction have been placed on the market by the Pratt & Whitney Company, Hartford, Conn. The frame is made in the form of a truss, with the outer and inner ribs flanged. The web between the flanges is comparatively thin.

The Model C gage is made with one solid anvil and two adjustable anvils. It is equipped with a Bakelite grip on either side to insulate the frame from the heat of the operator's hand.



Left—Model A Trusform Adjustable-Limit Snap Gage. Right—Model B. Above—Model C

In using the gage, the solid anvil is placed on top of the work in the machine, and the gage rocked into the gaging position. This brings first the "Go" anvil in contact with the work and then the "Not Go" anvil. This method of using a snap gage brings all the wear on the broad solid anvil surface, and eliminates to a great extent the possibility of marring the work by contact with the adjustable anvils. For bench inspection, the snap gage is usually held in a fixture or vise with the solid anvil down, so that the work to be gaged can be rolled or slid along the solid gaging surface.

The solid anvil is held rigidly in place by two screws. It projects beyond the end of the frame and beyond the adjustable anvils to permit self-location on the work. In addition, the solid anvil is made flush with the side of the frame to permit checking close to a shoulder.

The adjustable anvils of the Model C gage have a rectangular head. They are made of tool steel, heat-treated and lapped flat and square with the shank. The shanks are ground accurately, and when placed in the frame the anvils are parallel and in line. This permits interchangeability. The adjustable anvils are adjusted by push and pull screws engaged in threaded holes in both the anvil and the frame. These screws have right and left-hand threads, forty threads per inch, so that a single turn will advance or pull back an anvil 1/20th of an inch. This provides a sensitive adjustment for setting with size blocks. The locking sleeve for each adjustable anvil comprises two bushings and a locking screw. Each bushing is beveled, and each bears against one of the two flat surfaces on the anvil.

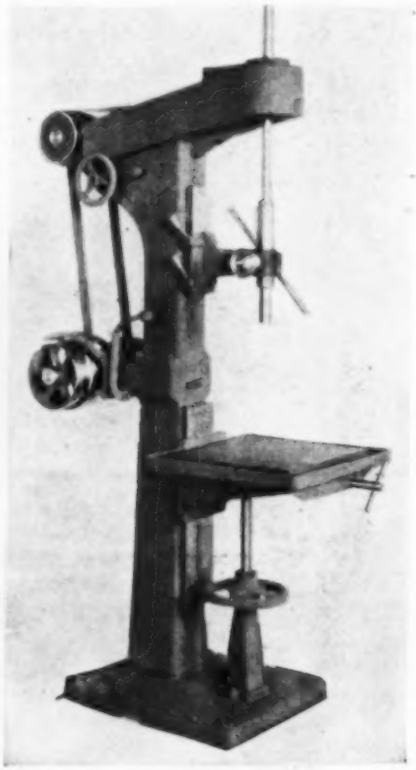
The Model B "Trusform" snap gage differs from the Model C in that four square adjustable anvils are used. These anvils are so placed in the frame that the gap between them is too small to allow the work to drop between. The anvil adjustment and locking devices for the Model B and Model A gages are the same, and require the use only of an ordinary screw driver. The adjustment is made by a push screw in the gage frame, which is in contact with the inner end of the anvil.

The Model A Trusform Gage differs from the others in that it has four round anvils with much smaller contact surfaces, and gives a more sensitive "feel."

The Model C gage is made in fifteen sizes of frames, which provide a complete gaging range from 0 to 12 in. The Model B gage is provided in eight sizes of frames, giving a range from ½ to 5 in. The Model A gage is available in eight sizes ranging from 0 to 5 in.

Reed Types S and SB Ball-Bearing Drilling Machines

Two sensitive drilling machines with capacity for ¾ in. drills have been placed on the market by the Francis Reed Company, 41-43 Hammond St., Worcester, Mass. The Type S has a plain-bearing spindle



with a ball thrust and the Type SB a full ball-bearing spindle. The same power feed as applied to the Type U machine is available on the Type SB unit.

As noted in the accompanying illustration, the design consists of a very few parts of large sections. The large diameter cones for a 1½-in. belt give unusual pulling power in a machine of this capacity. Endless belts are furnished. From one to six spindles can be had in either machine, the working surface of the tables ranging from 15⅜x16½ in., to 15⅜x 66½ in.

Specifications: Capacity, ¾ in.; Morse Taper No. 2; distance from center of spindle to column, 8¼ in.; spindles, center to center, 10 in.; spindle speeds, 600-900-1,300-1,900 r.p.m.; vertical travel of quill, 5½ in.; travel of head, 6½ in.; vertical travel of table, 12 in.; maximum distance from table to spindle, 27 in.; and weight, 600 to 2,400 lb.

Bliss Automatic Multiple-Disk, Friction-Clutch and Brake with Magnetic Control

To give full automatic features on punch presses, the E. W. Bliss Company, 53rd Street & Second Ave., Brooklyn, N. Y., is announcing an automatic multiple-disk, friction-clutch with magnetic clutch and brake control. The clutch is of the multiple plate type using the same friction disks and plates as on the standard mechanically operated clutch. All operating links and levers are eliminated. The pull of the magnet is transmitted directly to the moving plate of the clutch. Adjustment is made by a single threaded ring at the back of the friction plates. The air gap of the magnet is visible, a distinct advantage. The magnetic brake is of the type used with manipulator and crane motors and is specially wound to suit press operating conditions.

On the side of the press is mounted an operator's cabinet containing a four-station transfer switch. Two start buttons and one emergency stop are provided for each operator, and thus where two or more operators are employed all are safeguarded. These start buttons are made with special covers so that they can be operated with the heel of the hand and are the most suitable type for workers wearing heavy gloves. The start buttons are of the lock-in type to enable any of them to be closed when the full number of operators is not employed. Further, a foot switch can be provided to be operated with all hand buttons locked in.

The four stations on the transfer switch give the following conditions of working:

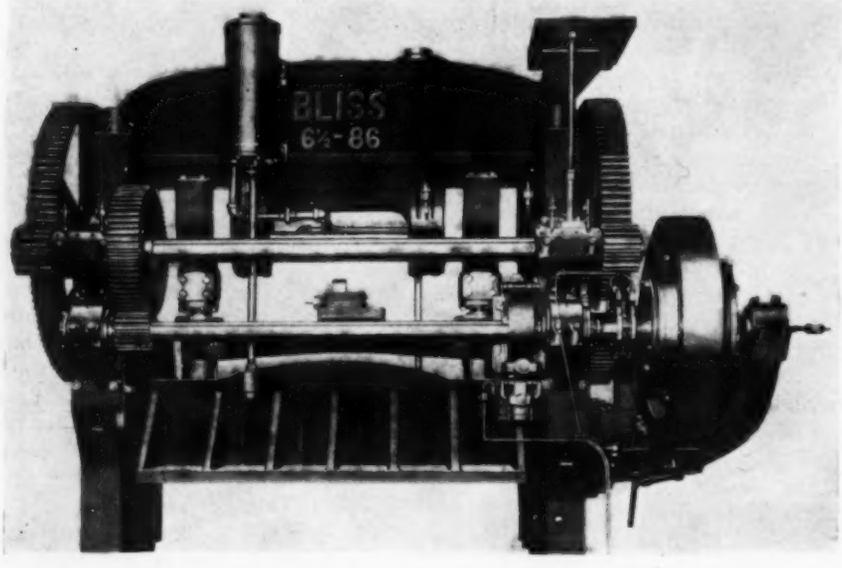
1. Automatic Top Stop: With all operators' hands on the start buttons, the clutch will engage although the hands are then removed, the press will complete one cycle and stop automatically with the slide at the top stroke. In this case the safety provision is that all operators must have both hands on the start buttons in order to engage the clutch.

2. Continuous Run: After the press is started, it will run continuously until stopped by depressing any one of the stop buttons. This is used when the work enables the operators to catch every stroke of the press.

3. Inching: A separate button is provided for this function, and the press runs as long as the button is depressed and stops immediately it is released. This station is used for die setting.

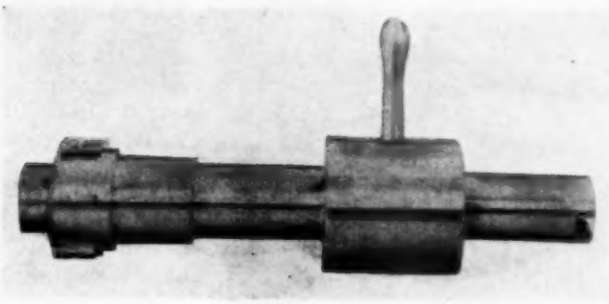
4. Automatic Top Stop with Sustained Hold: This condition is similar to the first, except that the buttons may not be released immediately the clutch is engaged, but must all be held until the slide reaches the bottom stroke. This provides additional safety on slow running presses where an operator might attempt to adjust the work on the die after the slide had started down. The length of time the operators are compelled to hold the buttons is determined by a cam. This can be made to require a shorter hold on the buttons than full down stroke; that is, until the slide is at half stroke. If a single operator releases one button too soon, the press will stop.

The control panel containing the relays and resistors for the clutch and brake magnets can be mounted in any convenient position. Direct current is required for operation.



Victor Valve-Seat Tap

The Landis Machine Company, Inc., Waynesboro, Pa., has developed a tap for tapping the valve-seat ring threads in gate valves. These threads have been difficult to tap because of the fact that the major diameters of the threads are larger than the port openings. The Victor valve seat tap is fitted with double-ended chasers, one end for each of the two valve-seat ring threads. Its construction is such that the chasers, when collapsed, will clear the port openings. The chasers are expanded to the cut-



Victor Collapsible Tap for valve seat rings of valves with parallel or angle seats

ting position by means of a handle after the tap has entered the valve body through one of the port openings.

The two threads are tapped with the same chasers in one chucking. The tap is suitable for valves with either parallel or angle seats. Valves with angle seats require a fixture of the trunnion type, with stops for bringing the valve-seat ring openings in line with the tap.

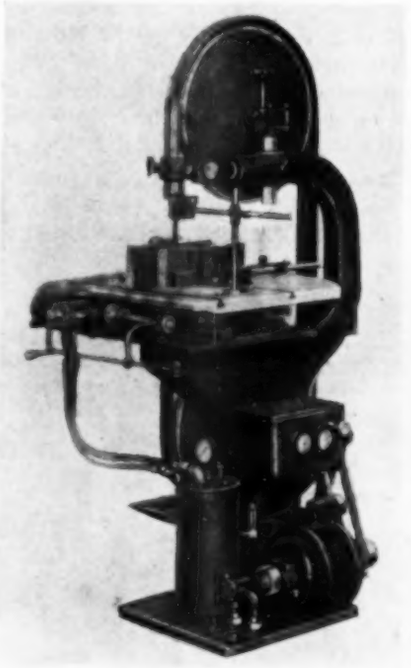
Laidlaw Type JM Metal-Cutting Bandsaw with Hydraulic Feed

A low-pressure hydraulic feed has been applied to the Type JM metal-cutting bandsaw manufactured by William Laidlaw, Inc., Belmont, N. Y. While primarily intended for use in toolrooms, laboratories, experimental departments, vocational schools, and other shops having a large variety of cutting to do, the machine is also suitable for use on production work.

The low-pressure feed pump is direct coupled to the motor shaft with a flexible coupling, and the reservoir and piping are located beneath and to the rear of the table but readily accessible. The stationary cylinder is mounted between the carriage and the table, the piston rod being directly connected to the latter. Oil can be admitted to either end of the cylinder. The oil is returned to the reservoir through an adjustable needle valve, and this valve controls the speed at which the table is fed forward. When the control valve handle is moved to the extreme position the table is rapid traversed. An adjustable tappet is provided to close the control valve and stop the feed when the table has traveled a predetermined distance, but because of the low pressure used (approximately 50 lb. per sq.in.) no damage can be done even though the tappet is not used. There is a positive stop attached to the front vise jaw, which prevents the saw from cutting into the vise. When this stop comes into action the relief valve opens and permits the oil to be returned to the reservoir.

A pressure of about 45 lb. per sq.in. is required for ordinary cutting, but provision is made whereby a pressure of 100 lb. per sq.in. can be obtained. A pressure gage is located on top of the oil reservoir.

The work table measures 26x26 in., and is of the same swivel design as formerly employed. With eight speed changes ranging from 100 to 725 ft. of saw travel per min., the machine gives a wide range of speed in cutting most metals. For cutting aluminum and other soft metals it is built with speeds up to 2,900 ft. per min. Overall height of the machine is 68 in., and distance from the floor to the carriage is 37 in. A ¾-hp. motor is required and the floor space is 38x38 in. Approximate weight, 1,115 lb.



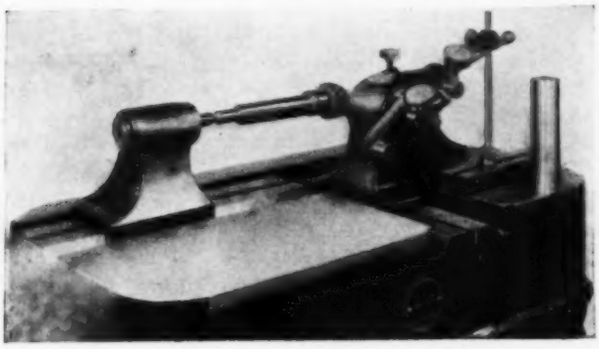
Laidlaw Type JM Metal-Cutting Bandsaw, showing the hydraulic cylinder and control for the worktable

"Red Ring" Model SIB Universal Gear Tester

For the measurement of the functions of helical gears, the National Broach & Machine Company, Detroit, Mich., has developed the Model SIB universal gear tester. An irregular or inaccurate spiral angle is the cause of loud noises in high-speed helical gears under load; hence, the necessity for the machine.

Both spiral angle and eccentricity of helical gears can be tested on this "Red Ring" Model SIB Universal Gear Tester

A rack tooth gage is inserted between the teeth in alignment with the axis of the gear. A sine bar having a center to center distance of the buttons of 6 in. is attached to the rear of the rack gage and is used to measure the spiral angle. With the gage fitted snugly between the teeth, the angle is measured by means of a stack of blocks. A dial indicator can be set to read zero on the blocks, and



Close-up of Gear Tester, showing centers for holding the work and the cross-slide

then the reading over the sine bar pin will give the variation in angularity.

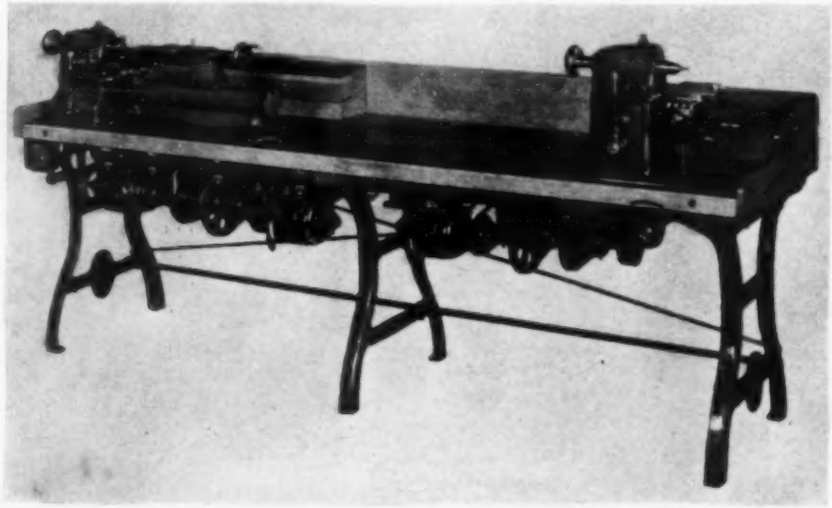
The following functions can be tested on the machine: (1) Spiral angle; (2) eccentricity; (3) index error; (4) tooth form; (5) gear centers for rolling; and (6) parallel check of spur teeth. The first two are taken care of with standard equipment and the last four with special equipment. Centers for mounting the gear and the cross-slide are furnished.

"Cataract" Bench Lathe and Milling Machine Unit

The "Cataract" motor-driven bench lathe, described on page 1045, Vol. 72, and the motor-driven bench milling machine, described on page 267, Vol. 74, of *American Machinist*, are now offered by Hardinge Bros., Inc., 4147 Ravenswood Ave., Chicago, Ill., on a single hardwood bench. Both machines are independently driven by electrical drive units mounted under the bench, featuring a 6-speed, V-belt drive.

For the lathe, the driving unit provides six spindle speeds in either direction, ranging from 200 to 2,000 r.p.m. Reverse is obtained through a train of bevel gears by means of a clutch. For the milling machine, reversal of the spindle is obtained through a standard reversing motor and reversing switch. Otherwise, the drives are the same, with two speed changes available by clutch and additional speeds available by shifting the belt on the multiple-groove motor pulley. The same design of headstock is used for both machines and is totally inclosed.

On the bench behind the milling machine is a box containing the swivel vise, dividing head, swivel plate for dividing head, universal adapter for dividing head, extra index plates, and a complete set of arbor chucks. Behind the lathe there is a longer box containing a full set of collets by 64-ths to the capacity of the lathe, a 3-jaw universal chuck, a 4-jaw independent chuck, and a drill chuck for the tailstock. This machine is offered particularly for experimental, laboratory, and toolroom use.



Cataract Bench Lathe and Milling Machine with independent drive units

Oxweld No. 12 Goggles

The No. 12 Oxweld goggles for welders, being placed on the market by the Linde Air Products Company, 30 E. 42nd St., New York, N. Y., are built to fit the eyes and are adjustable to conform to the individual nose. The eyepieces are joined with a leather strap, adjustable by means of a metal buckle.

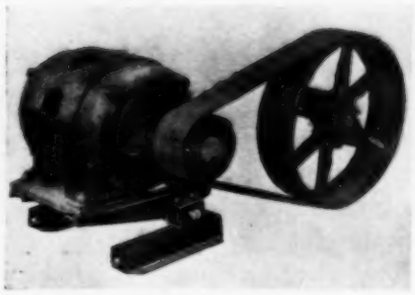
Ventilation is by means of patented ports on each side of the eye-cup, and the depth of the cup is such as to permit the circulation of cool air. The field of vision has been increased by the use of a 50-mm. lens instead of the ordinary 47-mm. lens. Brown color lenses, known as the "B" type, are available, and, in addition, a new green lens known as the "A" type is available in three different shades.

The lenses may be changed quickly. The molded plastic substance from which the goggles are formed is resistant to heat, light, and electric current.

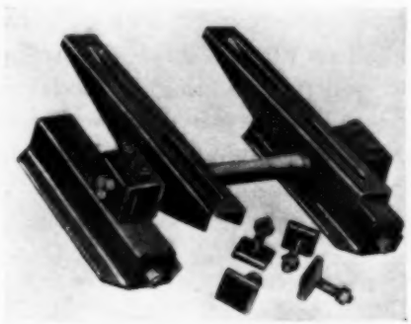
Kritzer Floating Motor Drive

Short-center drives, either flat belt or V-belt, can be evolved with the floating motor drive announced by The Kritzer Company, 515 West 35th St., Chicago, Ill. With this type of mounting the driving motor floats on the load, maintaining just sufficient tension on the belt to carry the load. The nominal increase in belt length during the operation is automatically compensated for without the use of idlers.

With this drive the weight of the motor is balanced and the motor torque regulates the belt tension. The weight of the motor does not hang on the belt. Thus, the heavier the load on the belt, the greater the torque reaction on the frame and the greater the tension on the belt. The mounting is made of pressed steel for



Kritzer Drive which has the motor pivotally mounted so that the weight sets up extra belt tension



Kritzer Pivoting Motor Base Assembly

strength and light weight, and the base affords flexibility of center distance. The pivot shaft is bronze bushed and locked in position. Bases for motors from ½ to 25 hp. are carried in stock.

TRADE PUBLICATIONS

AIR COMPRESSORS. The Davey Compressor Co., Inc., Kent, Ohio, has issued a booklet "4 Air Compressors Went to School," describing comparative data of the operation of the Davey compressor (air-cooled type) against three water-cooled types. The compressor makes liberal use of high heat-conducting metals.

ALLOY STEEL CASTINGS. The Duriron Co., Inc., Dayton, Ohio, has brought out an illustrated brochure on alloy steel castings of the "Durimet" and "Durco Nirosta" special analyses. Many representative types of castings are illustrated, and machining, welding, and heat-treatment data are offered, together with the physical and chemical properties of these two alloys.

CUTTING TOOLS. The O. K. Tool Co., Shelton, Conn., has issued a pamphlet entitled "Cutting Costs with Cutting Tools," describing the features and the manufacture of its tool bits and holders.

DIE SETS. Danly Machine Specialties, Inc., 2104-2130 So. 52nd Ave., Chicago, Ill., has issued the 7th edition of its loose-leaf catalog on standardized, interchangeable die sets. A feature is the information on the largest die set and die space that can be used on all standard makes and sizes of presses. Die makers' supplies are also listed.

ELECTRICAL LOAD CENTERS. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued Circular 1913, covering "Nofuze" Load Centers, which are groups of small circuit-breakers, used for the protection of branch circuits. The publication describes their construction and operation, and includes considerable application data.

MARKETING. The Thompson & Lichtner Co., Inc., Engineers, Statler Bldg., Boston, Mass., has issued a brochure entitled "Mass Marketing a Fallacy?", which points the way to true potential consumers through selective marketing.

PIPE WELDING. The Gas Products Association, 250 East Ontario St., Chicago, Ill., has issued a 44-page booklet on pipe welding, giving in condensed form complete information on the erection and welding of various types of welded-steel and wrought-iron piping systems for industrial uses. Cost data are included.

PULLEYS AND SHEAVES. The Henry Lindahl Foundry & Machine Co., 5900 Ogden Ave., Cicero Station, Chicago, Ill., has announced Catalog No. 24, which covers the complete line of machine-molded pulleys, conveyor pulleys, and ball-bearing pulleys, together with sheaves of all types. Complete information and tables are given for the designing of V-belt drives. Prices are given.

SHEET METAL DATA. The U. S. Department of Commerce, Bureau of Standards, has published Circular No. 391 entitled 'Standard Thicknesses, Weights, and Tolerances of Sheet Metal (Customary Practice)". This publication is for sale by the Superintendent of Documents, Washington, D. C., for $0.10.

SPEED REDUCERS AND GEARS. The D. O. James Manufacturing Co., 1114 W. Monroe St., Chicago, Ill., has published catalog No. 136 covering its line of continuous-tooth, herringbone reducers and gears, giving dimensions, prices and horsepower ratings, according to the speed and ratio. Illustrations of reducer installations are included.

STEEL. The Inland Steel Co., First National Bank Bldg., Chicago, Ill., has available a booklet, "Sizes We Roll and Standard Extras," including all standard extras and differentials applying to bars, plates, structurals, and rail steel products.

TIMKEN ENGINEERING JOURNAL. The Timken Engineering Co., Canton, Ohio, has published a revised edition of its loose-leaf catalog, the "Timken Engineering Journal", dated January, 1931. Dimension sheets for bearings with bores of 2½ in. and smaller have been changed to conform to the new tolerances of +0.0005 in., —0.0000 in. in bore, instead of +0.001 in., —0.000 in. General information on the application and fitting practices for these bearings is still included.

PATENTS

APRIL 28, 1931

Metal-Working Machinery

Fixture for Testing or Lapping Gears. Frederick E. McMullen and Alton P. Slade, Rochester, N. Y., assigned to Gleason Works, Patent 1,802,388.

Grinding Machine. Raymond Webster, Rochester, N. Y., assigned to Gleason Works. Patent 1,802,798.

Welding Machine. Henry S. Holmes, New York, N. Y., assigned to Metropolitan Engineering Co. Patent 1,802,-817.

Centerless Grinder. Clement Booth, Danbury, Conn., assigned to Cincinnati Grinders, Incorporated. Patent 1,803,-165.

Tools and Attachments

Mechanism for Feeding Metal Blanks. Reuben S. Crosby and Frank E. Newton, Hartford, Conn., said Crosby assigned to said Newton. Patent 1,802,-631.

Lathe Chuck. Oscar C. Kavle, Syracuse, N. Y. Patent 1,802,655.

Mechanism for Truing and Dressing Grinding Wheels. Ferdinand J. Hohnhorst and Ferdinand J. Kroeger, Covington, Ky. Patent 1,803,062.

Threading Die. Franklin Judge, Greenfield, Mass., assigned to Greenfield Tap & Die Corporation. Patent 1,803,192.

Measuring-Machine Micrometer. John W. Parker, Barrington, R. I., assigned to Brown & Sharpe Mfg. Co. Patent 1,803,283.

Processes

Method of Casting Metal. Earl C. Smith, Canton, Ohio, assigned to Republic Steel Corporation. Patent 1,802,-582.

Method of and Apparatus for Making Bearings. Edward P. Kerbruish, Cleveland Heights, Ohio, assigned to the Cleveland Graphite Bronze Co. Patent 1,802,723.

Furnaces

Electric Furnace. Fred A. Hansen, Milwaukee, Wis., assigned to Hevi-Duty Electric Co. Patent 1,802,892.

High-Temperature Electric Heating Furnace. John D. Morgan, Maplewood, N. J., assigned to Doherty Research Co. Patent 1,803,282.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, May 7, 1931

VOL. 74 NO. 19

Obsolescence at the Top

IN HIS recent broadcast over a national hook-up in reply to the Westinghouse salute to machine tool builders, President Johnson of the National Machine Tool Builders' Association proposed a change in the management point of view on equipment replacement. Heretofore the works manager or the superintendent has been put distinctly on the defensive when purchase of new equipment to replace existing equipment came up for consideration. He has had to prove beyond question of a doubt that the machines he wishes to buy are more than justified from every angle. Often he has hesitated to ask for all that he really needs because of the struggle ahead of him.

Mr. Johnson suggests that the presumably culpable old equipment be judged from the military rather than the civil angle; that it be adjudged guilty until its innocence is proved, instead of the contrary.

After all, why not? Why should not the old equipment be looked upon as an economic liability, an obstacle in the path of efficient production, unless it can be proved that it will produce as cheaply and as effectively as the best equipment available? Men are often judged on this basis, why not machines?

In ending his statement Mr. Johnson quoted this couplet: "Old machinery in the shop, shows obsolescence at the top." Is there obsolescence in your superstructure?

Accounting That Conceals Facts

LANGUAGE, according to a cynical writer of the long ago, was devised and too frequently used to conceal our thoughts. Accounting, as it is practiced in many factories, conceals the real facts quite as successfully.

In one plant two machines of similar make but of different vintage are carried on the books at widely different values. The older machine has a book value of $85, the newer one at $900. Yet, as a producing unit, the older machine is of greater value because nearly $500 was spent in rebuilding it and giving it valuable features that are not on the other machine. It produces more and better work than the machine valued at $900.

The cost of overhauling was charged to maintenance and does not appear on the books as an asset. The department is charged with over ten times more overhead on the less efficient machine than on the other. Such accounting methods are obviously bad and fail to give a true picture of the physical value of a plant or what should be expected of it. Neither do they act as a guide in any endeavor to reduce overhead or net costs.

Are We Soft?

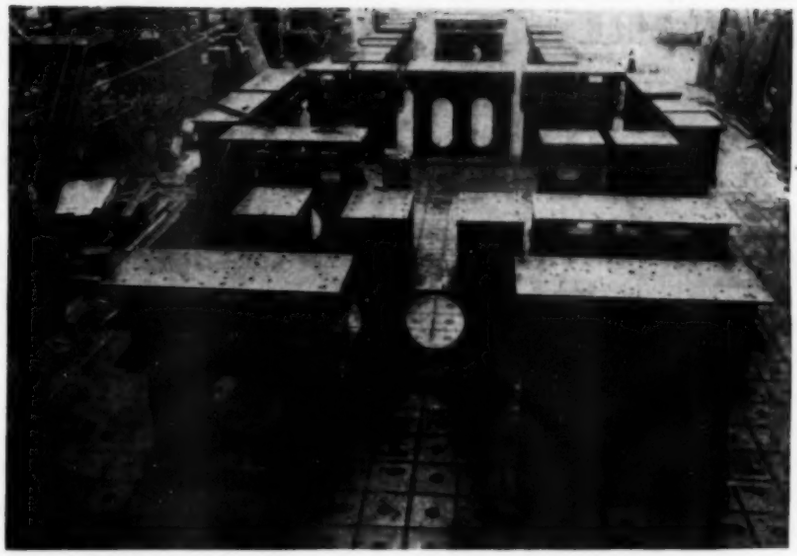
SOFT steel is of little use for cutting metal. The soft offspring of wealthy families are of little use to football coaches. Soft executives who have spent more time sitting in their chairs and telephoning their brokers than they have spent in walking through their plants and traveling to visit their customers are of little use to their companies when competition is tough.

Are we all too soft from years of having things come to us too easily? Is that why some of us have complained so bitterly and so loudly of late? Is there any hope for us?

Of course there is hope. Steel can be hardened by proper treatment. A good football coach can do wonders with a "smoothie," as college slang has it, if only his spirit be not as soft as his muscles. And adversity accomplishes miracles in stimulating sluggish executives and in improving the efficiency of top heavy organizations.

Think for a moment of the betterments that have taken place in your own organization and in other organizations with which you come in contact. They should be lean and sinewy, unhampered by surplus fat, hardened in the furnace of dull times. Now that they have started to go ahead they should go fast because there should be little surplus weight to be carried. Maybe we have been soft, but some of us are soft no longer.

NEWS OF THE WEEK



Not ruins of the ancient buried city of Pompeii but the firm steel foundation blocks on which giant turbines are placed for assembly and test in the Schenectady Works of the General Electric Company.

William LeRoy Bryant

William LeRoy Bryant, President of the Bryant Chucking Grinder Co., Springfield, Vt., died suddenly April 25. (A.M., p. 706g). Mr. Bryant was one of the most prominent machine tool manufacturers and widely know as the inventor of the Bryant chucking grinder. He was born in Northfield, Vermont, April 29, 1875, the son of Dr. William N. and S. Angelia Holbrook Bryant. Mr. Bryant is survived by his widow, Mrs. Blanche Brown Bryant and two sons, William J. and Allen L.

Mr. Bryant was a graduate of Black River Academy, Ludlow, Vt., and a member of the Class of 1898 of the University of Vermont, which conferred upon him the degree of Bachelor of Science. After leaving college he became associated with the Jones & Lamson Machine Co., ultimately becoming chief engineer. In 1909 he left Jones & Lamson to form the Bryant Chucking Grinder Co.

His contributions to the machine tool industry have been outstanding, most prominent of which is the suspended wheel slide control applied to various types of semi-automatic and automatic grinding machinery. He was a member of the A.S.M.E., and S.A.E., a director of the First National Bank of Springfield, and a director of the Associated Industries of Vermont.

Doyle Again Heads Welding Society

The annual election of the American Welding Society resulted in re-election of E. A. Doyle, Consulting Engineer of the Linde Air Products Co., and F. P. McKibben, Consulting Engineer of the General Electric Co., as president and senior vice-president. William A. F. Millinger of the Shell Oil Co., was elected Pacific Coast divisional vice-president, and H. C. Price of the Welding Engineering Co., has been elected Southern divisional vice-president.

A. M. Candy, Engineer of the Westinghouse Electric & Manufacturing Co., T. H. Deppeler, Chief Engineer of the Metal & Thermit Corporation, E. H. Ewertz, Consulting Engineer, and A. P. Gaynor of the John A. Roebling's Sons Co., were elected directors at large. Dr. C. A. Adams, Professor of Engineering of Harvard University, and President of the Welding & Research Corporation, was elected director of the American Bureau of Welding, and H. M. Hubart, Chief Engineer of the General Electric Co., was re-elected vice-director. J. H. Critchett, Head of the Research Department, Union Carbide & Carbon Research Corporation, was also elected a director. Membership of the Society increased more than 80 over the previous year.

Steel Institute Meets This Month

The 39th General Meeting of the American Iron & Steel Institute will be held at the Hotel Commodore, New York, on Friday, May 22. There will be three sessions, a forenoon session, an afternoon session, and a banquet in the evening. The program of technical papers includes: "Cooperative Research in the Iron and Steel Industry," by F. N. Speller, Director of the Department of Metallurgy and Research, National Tube Co.; "Shipbuilding and its Relation to the Steel Industry," by H. Gerrish Smith, Vice-President, Bethlehem Shipbuilding Corporation, Ltd.; "An Appraisal of Nitriding," by Marcus A. Grossmann, Vice-President, Republic Research Corporation; "A Thermal Study of an Open-Hearth Furnace," by William M. Henry and Thomas J. McLoughlin; "Corrosion Resistant Alloys of the Stainless Type in Use and Fabrication," by T. Holland Nelson, Consulting Metallurgist of the Midvale Co., and "A Review of Certain Gas Producer Practice," by Victor Windett, Manager of the Gas Producer Division, The Wellman Engineering Co.

Gray Iron Report Shows Upturn

The March trade report of the Gray Iron Institute, Inc., shows a decided increase over that of February, approximately five points. This is the third consecutive month that an increase has been shown over the preceding month and is also the second consecutive month that all three items, Production, New Business and Unfilled Orders, show an increase. This is the second time in nine months that this condition has prevailed. By districts, the Middle West-Southern territory shows the greatest activity. By normal volume, Class "A" plants, those having production of one to 100 tons per month, show greatest activity.

THE National Association of Purchasing Agents has approved the Standard Sales Agreement and Trade Customs of the Gray Iron Institute.

BUSINESS ITEMS

The Allis-Chalmers Manufacturing Co., Milwaukee, will increase its activities in the farm implement and tractor field through the acquisition of the manufacturing properties and business of the Advance-Rumely Corporation, LaPorte, Ind., and branch houses throughout the United States, according to a recent announcement. Payment will be made in Allis-Chalmers stock. Allis-Chalmers has become interested extensively in the production of farm and crawler tractors, and has recently purchased the LaCrosse (Wis.) Plow Co.

The Semet-Solvay Engineering Corporation, 40 Rector St., New York, N. Y., has acquired patents and manufacturing rights on the Koller gas producer and the Koller mechanical grate, together with the industrial gas equipment formerly manufactured and sold by the Gas Research Co., and the Smith Gas Engineering Co., of Dayton, Ohio.

The Northwestern Manufacturing Co., Ltd., Vancouver, B. C., has opened a plant at 2781 West Fourth Ave., where production of a complete line of electric refrigerators will be begun. This company is also experimenting, and intends shortly to market a new line of oil burners. Exclusive manufacturing and sales rights for the British Empire for refrigeration equipment have been secured from the Parker Ice Machine Co. W. G. Wright is vice-president and general sales manager, with A. E. Downey as president and H. A. Downey as secretary-treasurer. D. K. Parker is manager and C. D. Robinson chief engineer.

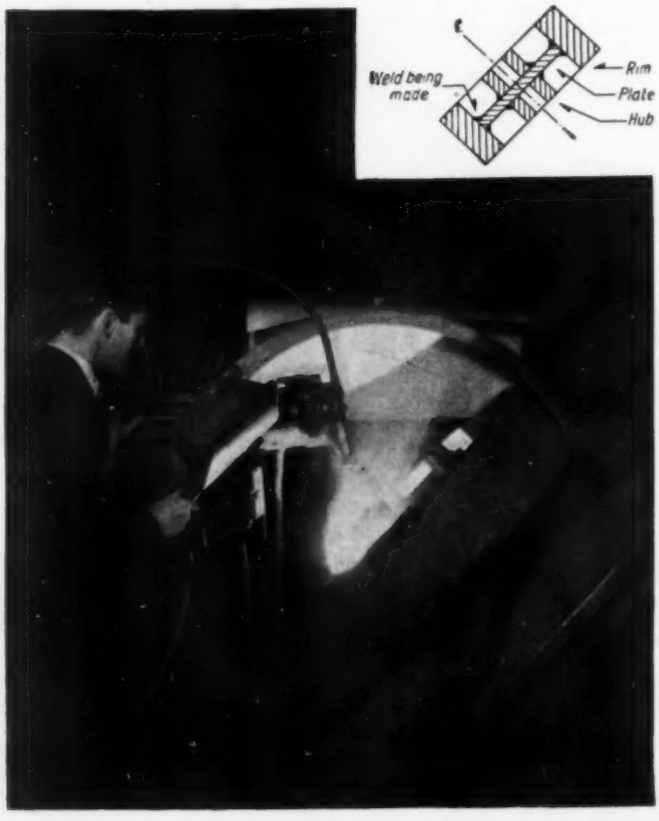
Officials of the Aluminum Co. of America have announced that the new aluminum plate mill, nearing completion in Alcoa, Tenn., will be in full operation within two months. Ingots large enough to be rolled into plates suitable for street cars, tank cars, railroad coaches, and other large-scale uses will be handled at the new mill.

The General Engineering & Manufacturing Co., St. Louis, Mo., has acquired by outright purchase the shaper manufacturing business of the R. A. Kelly Co., Xenia, Ohio. These shapers have been manufactured by the Kelly company since 1895. The General Engineering & Manufacturing Co. was founded in 1917.

Stockholders of the International Derrick & Equipment Co., and the Stacey Engineering Co., have approved their merger into the International-Stacey Corporation, with headquarters at Columbus, Ohio. Carmi A. Thompson, President of Stacey Engineering, will be chairman, and Harry M. Runkle, President of International Derrick, will be president and general manager of the new company.

The Big Four shops at Wabash, Ind., in disuse since the moving of shop headquarters of the division to Anderson, Ind., are to be wrecked.

The Toronto Industrial Commission announces that the International Resistance Co., Ltd., new Canadian manufacturing branch of the International Resistance Co., of Philadelphia, Pa., has leased factory space in Toronto.



Heavy fillet welding between the web and rim of a rotor spider, using a special work-handling tilting-head tool and an automatic welding head at the Westinghouse works in East Pittsburgh. It is necessary to tilt either the head or the work in order to obtain the most satisfactory results in welding sections above ⅜ in. thick

The Pfanstiehl Chemical Co., Waukegan, Ill., recently appointed Wood & Anderson, 915 Olive St., St. Louis, Mo., as representative for Southern Illinois, Missouri, Iowa, Kansas and Nebraska for the line of "SpecO" soldering pastes, salts, sticks, liquids, and sal ammoniac.

The Dardelet Threadlock Corporation, 120 Broadway, New York, N. Y., has granted a license to manufacture and sell oil-well sucker rods with the "Dardelet" self-locking screw thread to the S. M. Jones Co., Toledo, Ohio.

The American Rolling Mill Co., Middletown, Ohio, has recently announced a change in the nomenclature of iron and steel sheets in an endeavor to eliminate confusion, as well as to clarify the minds of the buyers of sheet products. Copies may be obtained from any Armco office.

The Roller-Smith Co., 233 Broadway, New York, N. Y., has appointed the Commercial Engineering Co., 1800 E. Street, N. W., Washington, D. C., as sales agent in the District of Columbia.

The main building and plant of Page-Hersey Tubes, Ltd., Welland, Ont., for the manufacture of seamless tubing, have been completed and placed in operation. It is expected that these works will go into full-time production upon receipt of the necessary raw materials of steel now on order. The mill was erected and equipped at a cost of $2,000,000.

The Western Bridge Co., subsidiary of the Hamilton Bridge Co., will undertake preparation of preliminary plans for a $500,000 plant on the site of the old Coughlin yards at False Creek, B. C. Before its acquisition by the Hamilton Bridge Co., the business of Western Bridge Co. was operated by J. Coughlin & Sons, Ltd.

The American Hardware Corporation, New Britain, Conn., through its subsidiary, the American Hardware Corporation of Canada, Ltd., has purchased the Springer Lock Co., Belleville, Canada. The plant, employing 120, will manufacture the "Corbin" line of hardware.

The South Boston (Mass.) Iron Works, 633 East Fourth St., has begun the manufacture of architectural iron products.

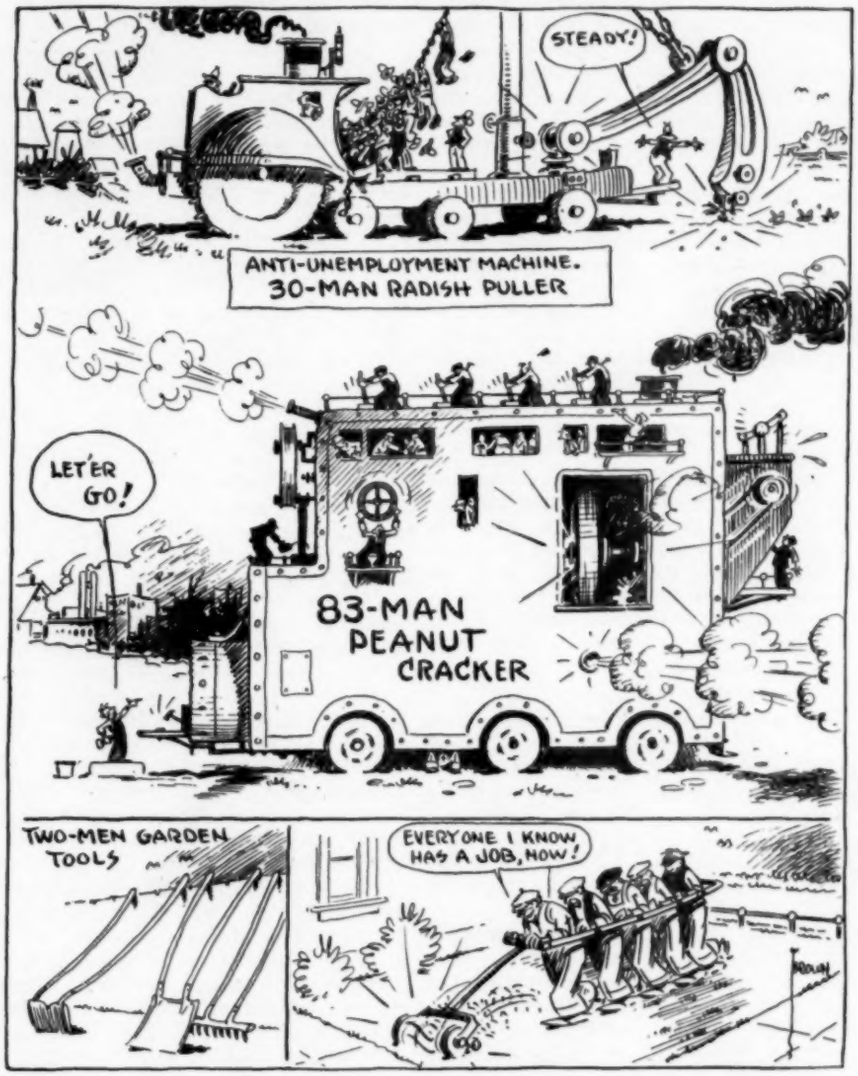
The Quinn Copper Co., Anacortes, Wash., capital $49,000, has been organized by Ivan Merrick and Dorothy Fry.

The Baldwin Locomotive Works has formed the Whitcomb Locomotive Co. to take title to the property of the George D. Whitcomb Co., Rochelle, Ill., recently sold at foreclosure. Officers of the Whitcomb company are: Samuel M. Vauclain, Chairman; George H. Houston, President; John P. Sykes, Vice-President; Harold H. Perry, Vice-President and General Manager.

The International Filter Co., Chicago, has changed its general office to 59 East Van Buren St. The laboratory will remain at the No. 1 plant at 329 West 25th St., Chicago.

Probably the Next Demand Will Be for Labor-Increasing Machinery

Copyright 1931, New York Tribune Inc. Courtesy New York *Herald-Tribune*



FACTORS influencing costs of production in the United States and Europe are set forth in a report prepared by a committee of American business men for consideration at the Congress of the International Chamber of Commerce at Washington, May 4 to 9. The report traces the progress made in determining costs of production as industry has developed from crude handicraft stages to modern organizations. Copies may be obtained from the Chamber.

APPLICATIONS for the positions of chief, principal, and senior instrument maker, and instrument maker upon which open competitive examinations have been announced must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than June 3. The duties are to design, construct, and repair scientific and technical instruments and apparatus of high precision. Full information may be obtained from the Secretary of the Civil Service Board of Examiners at any post office.

PERSONALS

A. L. Adams of the J. H. Whittemore Co., Naugatuck, Conn., has been elected a director of the Scovill Manufacturing Co., Waterbury, Conn.

C. H. Adamson, Secretary of the Stephens-Adamson Manufacturing Co., Aurora, Ill., manufacturer of conveyors and screens, has been placed in direct charge of sales and engineering for the Chicago territory. The company has also enlarged its Chicago office, establishing new headquarters in the Civic Opera Bldg., 20 North Wacker Drive.

I. L. Au Werter, representative of the Apollo (Pa.) Steel Co., in Michigan territory east of Grand Rapids, has been given similar representation for the Champion Rivet Co., Cleveland.

R. E. Affantranger of the Vlchek Tool Co., Cleveland, was elected president of the Purchasing Agents' Association of that city at a recent meeting. Other officers include: J. M. McKenzie of the West Steel Castings Co., vice-president, G. A. Collier of the Cleveland Automatic Machine Co., secretary, and R. C. Donley of Donley Bros. Co., treasurer.

Cyril Ainsworth, Safety Engineer on the staff of the American Standards Association for the past year, has been appointed assistant secretary to succeed F. J. Schlink, who recently resigned. Mr. Ainsworth has been actively engaged in the promotion of the use of the national safety codes through co-operation with the groups concerned with accident prevention work, state industrial associations, technical and trade associations, casualty insurance organizations, and state commissions.

Retirement of A. F. Banks, President of the Elgin, Joliet & Eastern Railroad, subsidiary of the Illinois Steel Co., and of F. L. Koontz, Secretary, was announced last week, effective May 1, as result of the inauguration of the U. S. Steel Company pension plan. Scott M. Rogers, Vice-President, will become president, and Edward Beecraft, Assistant Secretary, succeeds Mr. Koontz. Mr. Banks, who was 70 last February, has been with the railroad concern 37 years.

R. V. Baud of the Research Laboratories of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will present a paper on "Photoelastic Study of Contact Stresses in Gears" at the Fifteenth Annual Meeting of the American Gear Manufacturers' Association in Buffalo, May 7-9.

W. H. Benduhn, 664 Mission St., San Francisco, Calif., has been appointed representative for the Young Radiator Co., Racine, Wis., for the Pacific Coast district.

Capt. Harold G. Bowen, U. S. Navy, has been detached from duty at the Navy Yard, Puget Sound, Washington, and appointed Assistant Chief of the Bureau of Engineering, Navy Department. He will report for duty about July 6, relieving Capt. Ivan E. Bass, who has received orders as Aide on the Staff of the Commander-in-Chief, Asiatic Fleet.

J. E. Broderick, formerly in the sales department of the Aetna-Standard Engineering Co., Youngstown, Ohio, has become sales manager for Youngstown Steel Sales, the selling division of the Fitzsimmons Co., Youngstown.

B. W. Burtsell, who served his apprenticeship at Brown & Sharpe Manufacturing Co., Providence, has been appointed general manager, and will be a director and vice-president of the Massey-Harris Co., Ltd., of Toronto, Ont. Mr. Burtsell has been superintendent of the Packard Motor Car Co. of Detroit, and was more recently president and general manager of McKinnon Columbus Chain, Ltd., St. Catherines, Ont., prior to its absorption by General Motors Corporation.

Frank R. Bacon, formerly Chairman of the Board of Cutler-Hammer, Inc., Milwaukee, Wis., has been elected president to fill the vacancy caused by the death of Beverly L. Worden. The office of chairman of the board has been abolished. At the same meeting, other officers and directors were elected as follows: Vice-Presidents, F. L. Pierce, J. C. Wilson; Treasurer, H. F. Vogt; Secretary, W. C. Stevens. Directors include F. R. Bacon, F. L. Pierce, J. C. Wilson, H. F. Vogt, W. C. Stevens, T. Johnson Ward, Carl A. Johnson, L. A. Lecher, G. S. Crane, and E. A. Bacon.

John L. Blair, for the past three years associated with the W. A. Riddell Co., Bucyrus, Ohio, latterly as foundry and sales manager, has become identified with the Swedish Crucible Steel Co., Detroit.

W. R. Chamberlain has been appointed sales manager of the Marine Steel Corporation, Chrysler Bldg., New York City, to assume charge of sales of corrosion and heat-resistant alloy steel for marine applications.

C. R. Chandler, grandson of the founder of the Chandler Pump Co., Cedar Rapids, Iowa, has been elected president, succeeding W. H. Dunshee, president 13 years and for 43 years associated with the firm, who recently disposed of his third interest and has retired. Mr. Chandler is the third member of his family to be president of the corporation. A. E. Durin, one of the new stockholders was elected vice-president, to succeed C. R. Chandler; Walter E. Dunshee was chosen secretary; and George A. Johnson, employed in the office 30 years, treasurer. Directors elected include Messrs. Durin, Dunshee, and Chandler, and E. B. Cameron, Harold R. Trewin, Bruce McKay, and W. H. Dunshee.

H. G. Chandler, formerly Northwest divisional sales manager for the Hart-Parr Co., prior to its merger with the Oliver Farm Equipment Co., Chicago, has been appointed manager of sales promotion work for the Havana (Ill.) Metal Wheel Co.

F. C. Clayton, Secretary of Smiths Falls Malleable Castings, Ltd., Smiths Falls, Ont., has resigned to become president and general manager of Castings of Canada, Ltd. He will remain on the directorate of Smiths Falls Malleable Castings.

Garret A. Connors, Jr., Director of Purchases for the Truscon Steel Co., Youngstown, Ohio, has been appointed a vice-president. He has been associated with the company for 23 years.

Herbert C. Coy has resumed control of the Coy Manufacturing Co., Crawfordsville, Ind., manufacturer of metal products, to succeed James L. Rubel, to whom he sold the business in October, 1928, but who resigned in March of this year.

G. L. Crawford, in charge of Clinton electric welded fabric sales in the Tulsa (Okla.) territory, covering Oklahoma, Kansas, Texas, Arkansas, Louisiana, Mississippi and New Mexico, for the Wickwire Spencer Sales Corporation, a subsidiary of the Wickwire Spencer Steel Co., Inc., New York, has been transferred to the Chicago district. J. M. Mercer succeeded him in the Tulsa district.

Prof. Samuel W. Dudley, Chairman of the Department of Mechanical Engineering, Yale University, was the guest of honor at a dinner gathering of the New Haven Section, A.S.M.E., on April 9, where he received a replica of the A.S.M.E. 50th Anniversary Medal for his efforts in behalf of the anniversary celebration.

John Duffy, Superintendent of the Chemung Foundry Corporation, Elmira, N. Y., will sail May 15 on the *Olympic* for a short visit to England.

Don M. Eddy has been elected president of the Hanna Furnace Corporation of Delaware to succeed Charles A. Collins, deceased, and E. Kay Ford has been elected vice-president in charge of sales.

Bennett Epstein, Vice-President of the General American Tank Car Corporation, Chicago, has been elected a director to succeed Elias Mayer, formerly president, who has retired.

Ralph Evinrude has been elected a member of the board of directors of the Outboard Motors Corporation, Milwaukee, to fill a vacancy. He is the son of Ole Evinrude, President.

T. W. Frech, granted a leave of absence by the General Electric Co. on Jan. 1, 1930, to organize the RCA Radiotron Co. has been re-elected to his former position as vice-president of the General Electric Co. in charge of incandescent lamps, effective at once, it has been announced by Gerard Swope, President. J. E. Kewley will continue as manager of the incandescent lamp department.

S. S. French, Vice-President of the Lyon Metal Products Co., Aurora, Ill., has become assistant general manager in addition to vice-president, as result of the decision of F. S. Waters, President and general manager, to relieve himself of details of operation. A. W. Lauder has been advanced from general sales manager to vice-president in charge of sales; J. S. Sprout, Manager of the steel furniture division, has been made general sales manager, and E. D. Power, Manager of the Automotive Division, has been made director of research.

C. W. Given, formerly on the laboratory staff of the Ferro Corporation, Cleveland, has been appointed service engineer for the Michigan Steel Corporation, Detroit.

N. A. Hesler has been appointed president and managing director of Enamel & Heating Products, Ltd., with plants in the Maritime provinces. Mr. Hesler has been closely identified with the expansion of this concern and has been managing director for the past few years.

J. L. Hilton has resigned as sales manager of the fabricating department of the Dalzell Bros. Co., Youngstown, Ohio, to engage in business for himself at Warren, Ohio.

H. F. Holbrook has been elected treasurer and general manager of the W. A. Riddell Co., Bucyrus, Ohio, to succeed George M. Schmidt. W. G. Beebe has been elected secretary to succeed Mr. Schmidt.

Wesley Lambert, Past President of the Institute of British Foundrymen and a member of the Council of the Institute of Metals, has resigned as manager of the metallurgical department, J. Stone & Co., Ltd., Deptford & Charlton, England, but will continue in an advisory capacity.

D. H. Locke, President of the Locke Pattern Works, Detroit, a subsidiary of the American Radiator & Standard Sanitary Corporation, has been made vice-president and general manager of manufacturing for the American Radiator Co., to succeed A. E. Geddes, resigned.

James L. Mahon, Superintendent of the American Car & Foundry Co., Detroit, was elected president of the Detroit Foundrymen's association at the recent annual meeting. Other officers include: Peter W. Mulder, Vice-President; Neil McArthur, Secretary, and Fred A. Cowen, Treasurer.

G. H. Garcelon has been appointed manager of the Control Engineering Department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., to succeed J. H. Belknap, who has been transferred to the Engineering Division of the Pittsburgh district office. Mr. Garcelon was formerly manager of engineering for the Company's Works at East Springfield, Mass., and has been with Westinghouse since 1903.

CONRAD N. LAUER
Nominated for the presidency of the A.S.M.E.

E. F. Northrup, Vice-President and Technical Advisor, Ajax Electrothermic Corporation, Trenton, N. J., is on a European business trip.

Grant Pierce, formerly head of the National Radiator Co., Providence, R. I., has become vice-president in charge of sales for the H. B. Smith Co., Westfield, Mass.

J. D. Roberson of the Dallas (Texas) office of American Cast Iron Pipe Co., Birmingham, Ala., has been transferred to the New York office at 117 Liberty St., to assist E. W. Herrmann, Eastern and Export Sales Manager.

W. C. Schmeling has been elected president and general manager of the Wisconsin Art Bronze & Iron Co., Milwaukee. He has been manager of the Milwaukee plant of the General Bronze Corporation for the past two years.

Stanley W. Stedfast has been made secretary and assistant to the president of Stedfast & Roulston, Inc., Boston.

M. G. Sternberg, formerly general manager of the Hubbard Steel Foundry Co., East Chicago, Ind., main plant of the Continental Roll & Steel Foundry Co., has been placed in charge of operations for the parent company. Henning A. Foresberg has been appointed superintendent of the Hubbard division. James Thomson has been made chief engineer of the organization.

H. W. B. Swabey has been appointed a director of J. T. Donald & Co., Montreal and Toronto. Mr. Swabey has been associated with the Donald organization since 1926.

E. James Watkins, Toronto, Ont., has been appointed manager of the McLaughlin Motor Car Co., Ltd., Winnipeg, succeeding R. McKenzie, who died recently.

C. G. Wennerstrom, formerly chief engineer of the Foote Brothers Gear & Machine Co., has joined the Universal Gear Corporation, 327 South La Salle St., Chicago.

George W. Wiard has been appointed Detroit representative for the Walker Manufacturing Co., Racine, Wis.

John Winkler, formerly with the Cleveland Enameling Manufacturing Co., now has charge of porcelain enameling operations at the Youngstown Pressed Steel Co., Warren, Ohio. Peter Wachovec, formerly with the Vitreous Enameling Co., Cleveland, has joined the Youngstown Company's porcelain enameling department.

OBITUARIES

Herman V. Bittorf, 55, Treasurer of the National Manufacturing Co., died April 20 in Sterling, Ill., following a stroke of paralysis. He had been vice-president of the manufacturing concern until a few months ago when failing health forced his retirement.

George M. Bole, 69, formerly president of the Pittsburgh Steel Construction Co., died April 20.

Francis Buckingham has been appointed sales engineer for the Baldwin-Southwark Corporation.

Edgar Green, 67, Production Manager of the Columbus (Ohio) Malleable Iron Co., died April 21.

Charles W. Greening, who has been identified with the Toledo (Ohio) Machine & Tool Co. for over 30 years, the greater part of the time as secretary and treasurer, died April 29 after a lingering illness.

Charles M. Holbrook, 73, for many years purchasing agent of the National Transit Pump & Machine Co., died recently in Oil City, Pa., following a brief illness.

Dr. Isadore Kitsee, 87, holder of more than 2,000 inventions, including a refrigerator car, a new type of coal breaker, railroad signals and many telephone units, died April 26 after a one-month illness.

Arthur Stennett Martin, 46, Engineer for the Firth Sterling Steel Co., McKeesport, Pa., died April 22.

Patrick McNicol, Production Manager and part owner of the National Drawn Steel Co., East Liverpool, Ohio, died recently.

Howard C. Mills, for 26 years a mechanical engineer for the Semet Solvay Co., Syracuse, N. Y., died suddenly in a New York City hospital recently following a heart attack.

Frank V. Oldham, 57, President of the Cocker Saw Co., Lockport, N. Y., died April 24.

Thomas M. Richards, 78, formerly sheet mill superintendent of the Dover Works, American Sheet & Tin Plate Co., New Philadelphia, Ohio, died recently.

Joseph F. Savage, 46, from 1919 to 1926 Vice-President of the Hamilton (Ohio) Furnace Co., died in New York April 18.

Newell S. Thomas, 49, Assistant Treasurer of the Rome Division of Revere Copper & Brass Inc., died suddenly April 24.

John Wegner, Jr., 56, Sales Manager of the National Enameling & Stamping Co., Milwaukee, died April 19.

Clinton G. Wilderson, 58, President of the Crescent Machine Shops, Leetonia, Ohio, died April 19.

FORTHCOMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.
Fourth New England Meeting, Hartford, Conn., June 1-4.
National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN STEEL & HEAVY HARDWARE ASSOCIATION — Twenty-second Annual Convention, May 18-20, William Penn Hotel, Pittsburgh. B. R. Sackett, 505 Arch St., Philadelphia, secretary.

NATIONAL FOREIGN TRADE COUNCIL—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

NATIONAL ASSOCIATION OF FOREMEN—Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS—Summer meeting, June 14-19, White Sulphur Springs, Va. Green Brier Hotel. J. A. C. Warner, secretary, 29 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

NATIONAL METAL CONGRESS AND EXPOSITION — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL—20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

The last week in April was probably the slowest so far this spring, both inquiries and orders being fitful. There is little to indicate an early pick-up unless general business drops its imitation of Rip Van Winkle. One New Jersey printing press manufacturer, seeing two years' worth of orders coming in, has purchased a long list of tools, all of them second-hand. There are a number of big orders for general equipment being let, among them one from the New York subways and another from the Bush Terminal Company, but their effect has not yet been felt in machine tool sales. Prospects look good for fall, but present indications are slow.

CHICAGO

No change in the machine tool situation is reported. The hope that by May 1 there would be indicated an upward trend has not been realized. It is now thought that the market will not improve until fall. Inquiries are low. Business for April was disappointing, having, except in a few cases, been below that of March. Such sales as are reported represent shop equipment necessary in order to maintain production efficiency. The City of Milwaukee is in the market for a geared-head, motor-driven lathe. The Chicago Board of Education is asking prices on a motor-driven, 24-in. band saw.

DETROIT

Sales do not justify the optimism of dealers. Prospects are equally lacking in radiance, and a note of pessimism has crept in. Automobile and accessory manufacturers are still holding tight to the purse strings. The future of business and industry is still so uncertain that no one cares to take any risks that are not actually forced upon them.

Inquiries and requests have increased in the last three weeks, but so few of these have been resulting in new business that the average dealer does not place any great importance or value on them. It does seem to indicate a repressed optimism here and there throughout the automobile industry, but such things have happened before.

SOUTHERN DISTRICT

Machinery and machine tool trade remained steady the past fortnight. Continued activity in road and building construction circles in the Southcentral area are holding conditions at a favorable level. This is reflected in demand on the road and building equipment dealers for various types of machinery, but in no way has been felt by the metal-working plants. The Southeastern section, as well as Texas, has been spotty with no marked improvement in sight.

No large orders have been reported. Buying continues spasmodic and scattered. Small tools constituted the bulk of demand. Stocks maintained at central points are reported as smaller. While there is a tendency toward better freight loadings, it has not yet reflected any activity among the railroads other than the normal flow of business. Industrial buying accounts for but little of the business done.

CINCINNATI

The past week's market showed no sign of further recession. While in a very few cases there was a shade of improvement in sales, the best the majority could do was to hold its own. Local selling agents note no change in demand and see no definite indication of an immediate upward trend of any importance. With few exceptions, orders received were for single tools for replacement. Business was well scattered geographically.

■

APRIL did not live up to expectations in machinery and machine tool markets. While single districts report upturns for the month, the general trend was slightly downward. There are but few indications of a change for the better before fall, machine sales simply mirroring the apathetic condition of the general market. From some districts, increases in general business are reported which should filter through as tool orders through the summer.

NEW YORK had its slowest week so far this spring, probably partly because of its nearness to Wall Street; if this reasoning is correct, the upturn toward the end of the week should help sales. Several big general equipment orders were placed, and some second-hand tools were sold. Chicago has nothing to report except a pair of municipal inquiries. Detroit, until lately optimistic, seems inclined the other way, for though inquiries increase, no one seems disposed to do anything about them. Southern District trade held steady, but sales are principally road machinery with machine tools quiet, buying being largely for small tools. Cincinnati also held even, but did little else.

NEW ENGLAND sales held the average of the last two months, although small tools are going a little better and the Navy has taken a few tools. Cleveland sales took a turn toward the better last week, after several weeks of quiet. A number of orders and lively inquiries are on tap there. Philadelphia, conversely, is in the doldrums, with principally used machinery being sold. Buffalo held about even, some tools going to the General Electric plant at Erie. Milwaukee is expecting inquiries and commitments.

NEW ENGLAND

Machine tool sales continue at or near the level characteristic of both March and April. While this level is well above rock bottom, it is far from expectations, and only slight changes are registered from week to week. An upturn in distribution of small shop tools is significant, and may be regarded as a feature in a market practically devoid of color.

Closings on machine tools for the Navy Department has brought a number of good orders to New England builders. Inquiries, as a whole, have slumped and are regarded as less important. The trade is returning quotations in more routine fashion, and looks for no immediate action.

Officials anticipate no sharp upward trend for some time to come; on the other hand no general recession is expected from the existing level. Action in grinding machine centers is largely built around foreign bookings. This class of business holds strong, while domestic companies find time to place only an occasional order.

CLEVELAND

Sales of machine tools showed a tendency toward improvement during the last half of April. A number of quotations filed away as dormant suddenly became active and were closed. The month as a whole, however, was not up to expectations and showed a slight decline under March. The Youngstown Sheet & Tube Co. made a $40,000 purchase for machining "backing up rings." A radio manufacturer made an unexpected purchase for replacement. A few buys of single tools by general industrialists also enlivened the market.

Prospective new business is more encouraging at the present time and indicates that the month of May will hold better promise. Bids are out for tools for manual departments of two new high schools in the county. General Electric is preparing a list for its new Cleveland lamp factory. A manufacturer of axles and brakes will spend $75,000 for additional tools for a plant expansion. U. S. Government officials at Dayton are asking for bids for three open-side planers and ten hand tools for various airports. Machine shops and automobile accessory concerns are inquiring for single items.

PHILADELPHIA

Business in the machinery and machine tool industry continued in the doldrums during the past fortnight. Manufacturers, sales agents, and jobbers find little encouragement in the immediate prospect, and inquiries have been almost nil. Probably the only indication that can be considered bright is that reported by one dealer in used machinery, who has had calls for used machinery from textile and hosiery mills and rug manufacturers.

A dealer in machine shop equipment reported some activity from Buffalo and Kansas City from milling companies. It is hand-to-mouth buying, with no sizable orders in sight.

BUFFALO

Buffalo produced about the same amount of machine tool business in April as in each of the two preceding months. There was no real increase and the three months average surprisingly close. There does not seem to be much reason to expect an increase during May or June and most dealers have given up hope of any real improvement until autumn.

Some dealers made worth-while sales to the Erie plant of the General Electric Co., where a considerable sum of money was spent for boring machines and many other pieces of equipment. It is understood that equipment for the new Ford plant in Buffalo was not bought locally, that some of it at least is being brought to Buffalo from other plants. Some orders for electrical equipment have been placed.

MILWAUKEE

Manufacturers of machinery and machine tools here generally report that business during the month of April held up fairly well with the March volume, which was the best of recent months. Inquiries are reported as about the same or showing some improvement. There is a difference of opinion as to what is expected for the immediate future. It is generally admitted that volume business cannot be expected to materialize until fall. On the other hand, several manufacturers claim that May will see the placing of a number of substantial orders. Among those who are said to be ready to make commitments are the Detroit automotive industries, several large electrical manufacturing companies, and farm implement manufacturers. Steel and paper mills and a few export orders from Russia have also been factors in the local situation, as have artificial ice and refrigeration machinery plant orders.

BUSINESS • BAROMETER

The figures that indicate business trends are beginning to be a little more encouraging

THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE British Chancellor of the Exchequer, though an invalid, is the chief financial minister of the Government, and his speech submitting his budget for 1931 was the most important as well as the most favorable news published last week. To the surprise of everyone, including the Liberals and Conservatives, Mr. Snowden announced that the Government would be able to get along during the next twelve months without any increase in taxation, excepting a land tax of one penny on the pound to be levied on all the land in the United Kingdom that is not specifically exempt from taxation.

Although it is a novelty, and there is some protest against it, this land tax will probably be accepted without effective objection by the British taxpayers, who are thankful that the financial burden that they are condemned to bear is not to be otherwise increased. As far as there has been time to observe it, the effect upon British trade has been stimulating, and cables from London express a spirit of optimism that is refreshing. It is admitted that the English shipping business is poor, but there is increasing activity in many other directions, and the textile industry in particular seems to be more cheerful.

The Prince of Wales has returned from his South American trip and one of the English papers jocularly remarked that he had brought orders for $150,000,000 worth of British goods in his traveling bag. It was explained that this statement might not be statistically accurate, although it expressed British appreciation of the great service that the heir to the throne had recently rendered English trade.

These observations are prompted by the fact that the world's financial history since the Napoleonic Wars shows that a depression in America has often been checked and dissipated by an improvement in British trade and a demand for the goods in which English merchants and industrialists specialize all over the world.

America may profess to be afraid of this competition, but the English speaking peoples are getting closer together as the years roll by, and statesmanlike men on both sides of the Atlantic must be gratified by the progress toward Anglo-American unity that is being achieved from day to day.

The cheerful reports cabled from London have been all the more welcome because the Wall Street region was greatly depressed last week. Within the past ten days two important Stock Exchange firms, Pynchon & Co. and West & Co., suspended payment, and the rather lugubrious rumors in circulation made the whole community blue. But the suspensions announced did not cause any great surprise, and no other failures of importance are now expected. Therefore the sun ought soon to be shining again, and men are certain to recover their hopefulness as they cannot live long in an atmosphere of despair. Even as this is written the stock market is commencing to show its recuperative power, and the declines registered in a number of stocks have been partially if not entirely recovered.

The figures that indicate the business trend are beginning to be a little more encouraging. Car loadings show some improvement, and while they are not as large as last year, the deficit is not as great as formerly.

In the textile industry, including wool and rayon as well as cotton fabrics, there is also some improvement, and most of the mills in the South are said to be running at day-time capacity. In New England there is still more or less idleness, but the larger mills are gradually getting active, and merchants report a better distributive demand. Probably the most important feature of the situation is the low level at which commodities are selling.

In the United States a little less is heard of unemployment. It may be that the spring weather has provided farm work for many of those who want it, but whatever the reason it is certain that those who are in need of jobs are not as numerous as they were.

Railroad earnings are also a little better than they were, but passenger traffic is still disappointing. It is admitted that the future is largely dependent upon the outturn of the crops that will be harvested during the coming summer and autumn. Thus far the outlook seems to be satisfactory. A fair yield is expected from wheat, but it is too early to speak positively with regard to the other crops.

The information with regard to the cotton crop is decidedly confusing. An average of opinion would probably put the acreage at a decrease of about 12½ per cent. The boll weevil experts are, however, predicting that the weevil will do a great deal of harm during the coming season, and as no one can disprove this statement it stands uncontradicted.

Money continues easy at 1 to 1½ per cent for call loans, and the Federal Reserve Bank of New York appears to be utilizing its influence to avert further shipments of gold to this country. In the circumstances interest rates seem to have reached the irreducible minimum, and those who have use for borrowed capital are again advised to provide themselves with what they need before the movement of the crops commences or rates begin to show some advance.

THE BUSINESS WEEK

May 6, 1931

The persistently static condition of business contrasts with continued declines in commodity and security markets. . . . Our index, at 78.8% of normal, still lingers around the levels of the beginning of the year, with slight fluctuations of no significance. . . . The decline in steel activity seems to have slackened slightly this week, but the seasonal drop from March has been a bit sharper than usual, and prices continue to weaken. . . . Building is not holding up well, but there is still some slight encouragement in the residential field. . . . Carloadings, especially in merchandise and miscellaneous commodities, have made a better showing this week and support other indications of slightly quickened trade activity. . . . But there is still no sign on the horizon of any large-scale action from any source sufficiently strong to offset the certainty of a stagnant summer. . . . National business meetings promise no program. . . . Federal Reserve pressure on short-term money rates seems to be correcting international exchange maladjustments. . . . But it is doubtful whether a discount rate cut to the lowest levels on record will break the deadlock in long-term capital markets without vigorous direct action through large-scale security purchases by the Reserve banks. . . . They will probably be driven to it before the fall dispels the illusion of automatic recovery.

©The Business Week

Copyrighted
Theodore H. Price Publishing Corporation
95 Broad St., New York

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

BUYING of steel materials has slumped appreciably in the last week but there is still a fair volume going into the manufacture of automobiles, steam shovels, road graders and reinforced-concrete construction. New classification of steel sheets will clarify situation as to uses of these products, rather than exert influence toward changes in price. While scrap, heavy lead is up 0.15c. per lb. and copper in small lots holds steadily, sharp declines occurred during the week in tin, lead and zinc. Lead prices are lowest since 1921 and zinc, since 1896. Slump in steel affected zinc, in that latter is used extensively for coating.

(*All prices as of May 1, 1931*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@18.76
Virginia No. 2 (Silicon, 1.75@2.25)	22 29
Basic	17.00@17.25
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	17.50
Basic	17.00@17.50
Bessemer	17.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.85@1.90	3.35†	3.00	3.20‡
No. 12	1.90@1.95	3.45†	3.10	3.25‡
No. 14	2.00@2.05	3.55†	3.20	3.30‡
No. 16	2.10@2.15	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.05@2.15	3.60†	3.40	3.30
No. 22	2.20@2.30	3.75†	3.55	3.45
No. 24	2.25@2.35	3.80†	3.60	3.50
No. 26	2.35@2.45	3.90†	3.70	3.60
No. 28	2.50@2.60	4.05†	3.85	3.75
Galvanized				
No. 10	2.10@2.20	3.65†	3.20	3.35
Nos. 12 to 14	2.20@2.30	3.75†	3.40	3.40
No. 16	2.30@2.40	3.85†	3.50	3.50
No. 18	2.40@2.55	4.00†	3.65	3.65
No. 20	2.60@2.70	4.15†	3.80	3.80
No. 22	2.65@2.75	4.20†	3.85	3.85
No. 24	2.80@2.90	4.35†	4.00	4.00
No. 26	3.05@3.15	4.60†	4.25	4.25
No. 28	3.30@3.40	4.85†	4.50	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. butt	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1⅛	1¼
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon	3.40	3.40	3.35
Cold fin., flat or square	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.00	4.00	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, $\frac{3}{16}$-in. thick by $\frac{3}{4}$-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			10.75
Tin, Straits, pigs, New York			25.75
Lead, pigs, E. St. Louis	3.80	New York	5.25
Zinc, slabs, E. St. Louis	3.35	New York	4.75

	New York	Cleveland	Chicago
Antimony, slabs	10 00	10 00	10.75
Copper sheets*	19.12½	19.62½	19.37½
Copper wire*	11.25	11.37½	11.37½
Copper, drawn, round*	18.37½	18.62½	17.87½
Copper tubing*	22.37½	22.12½	21.87½
Brass sheets, high*	17.12½	17.00	16.75
Brass tubing, high*	22.00	21.87½	21.62½
Brass rods high*	15.37½	15.25	15.00
Brass wire, high*	17.75	17.50	17.25

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%, f.o.b.	24.00	24.30	23.30
Zinc sheets (casks)	9.75	10.50	10.36
Solder (½ and ½)	.2087½	.2150	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	43.50
Commercial genuine, intermediate grade	33.25
Anti-friction metal, general service	28.50
No. 4 babbitt, f.o.b.	9.50

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.50	7.50	6.75@ 7.25
Copper, heavy, and wire	7.00	7.00	6.25@ 6.75
Copper, light, and bottoms	6.00	6.00	5.50@ 6.00
Heavy lead	3.25	3.25	2.50@ 3.00
Lead battery plates	1.25	2.00	1.75@ 1.87½
Brass, heavy, yellow	4.00	4.25	4.00@ 4.25
Brass, heavy, red	6.25	6.75	5.75@ 6.25
Brass, light	3.25	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.25	4.50	4.00@ 4.50
Zinc	1.25	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.13	$0.13
Cotton waste, colored, per lb.	.05½@.09	.09	.09
Wiping cloths, colored, per lb.	.10	.08	.09
Sal soda, per lb.	.01¾	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.096	.099	.106
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Discounts from list:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30 –5%	40%
Rubber transmission—List price, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60-10-10%	50–10%	60%
Second grade	70-10%	60– 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1587½	.1587½	.2125
Solder (½ and ½)	per lb.	.2087½	.22	.28
Cotton waste, white	per lb.	.07@.11	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65%	65–10%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.50
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.00
Structural, round head, broken kegs, net	4.50
Tank, 7/16-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$9.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mass., Boston—Bureau of Yards & Docks, Navy Dept., Washington, D. C.—will receive bids until May 25 for gasoline operated locomotive crane for Marine Railway, Navy Yard here.

Minn., Minneapolis—Bd. of Education, F. S. Gram, City Hall, Purch. Agt.—will receive bids until May 18 for tools and equipment, including two lathes, 5 wood-turning lathes, two grinders, double-seaming machine, turning machine, etc., for new junior high school.

N. Y., New York—Bd. of Education, W. C. Martin, Supt. of School Bldgs., Flatbush Ave. Ext. and Concord St., Brooklyn—will receive bids until May 13 for equipment for shops at Textile High School, West 18th St. and 9th Ave.

O., Cleveland—Bd. of County Commissioners, Court House, F. J. Husak, Clk.—one core drill machine for road improvements.

O., Cleveland—Lempco Products Inc., Dunham Rd. (axle, gears, brake drum manufacturers)—tools and equipment for proposed 70 x 180 ft. addition to factory.

O., Dayton—U. S. Government, c/o Major R. M. Jones, Dayton Airfield—will receive bids until May 19 for three 24 in. open side planer shapers, also until May 30 for tinners hand tools for various airports.

O., Shaker Heights—Bd. of Education, J. W. Main, Clk.—will receive bids until May 25 for woodworking equipment for new Senior High School.

Wash., Seattle—Bureau of Yards & Docks, Navy Dpt., Washington, D. C.—will receive bids until June 3 for 250 ton stationary hammerhead crane, electrically operated; 20 ton traveling tower crane having gasoline electric power and 10 ton traveling gantry crane with traveling revolving jib, gasoline electric power at Navy Yard, Puget Sound here. Spec. 6482.

Ont., Ingersoll—Ingersoll Machine Tool Co., E. A. Wilson, Mgr.—interested in prices on additional equipment for the manufacture of cold drawn steel, also new furnace for recently acquired rolling mills. $50,000.

Opportunities for Future Business

Ark., Fort Smith—W. E. Womble & Sons, 300 Albert Pike St., will build a 1 story steel fence post plant. Work will be done by owner's forces.

Calif., Los Angeles—Buttress & McClellan, 1013 East 8th St., manufacturers of machinery and parts, plans the construction of two 1 story, 50 x 200 ft. plant units. Estimated cost $40,000.

Calif., Salinas—City, M. R. Keef, Clk., will soon award contract for the construction of a machine shop.

Conn., Meriden—Bd. of Trustees, Industrial School for Boys, E. King, Pres., received lowest bid for the construction of a group of school buildings, including service building, work shop, garage, etc., from Merritt, Chapman, Scott Corp., 292 Pequot Ave., New London, $550,503. Noted Jan. 22.

Ill., Chicago—Edward Katzinger Co., 1959 North Cicero Ave., awarded contract for the construction of a 2 story, 200 x 220 ft. addition to factory at Cicero and Armitage Aves.

Ill., Joliet—Bitterman Steel Products Co., F. J. Bitterman, Pres., plans the construction of a 90 x 200 ft. factory on Collins St.

Md., College Park—University of Maryland, awarded contract for the construction of a 3 story, 66 x 115 ft. engineering building. Noted April 16.

Mass., Cambridge (Boston P. O.)—Pan-American Products Co., Park Sq. Bldg., Boston, is receiving bids for the construction of a 1 story service station here. Private plans.

Mass., Holyoke — Dept. of Public Works, awarded contract for a 3 story, 70 x 230 and 65 x 75 ft. vocational school at Pine Beech and Franklin Sts. $133,700. Noted April 30.

Mass., Peabody—Carr Leather Co., 111 Foster St., awarded contract for the construction of a 5 story, 45 x 100 ft. factory. Estimated cost $40,000. Noted April 16.

Minn., St. Paul—First National Bank, E. A. Tyler, Dir. of Bank Properties, 602 Merchants National Bank Bldg., awarded contract for the construction of an 8 story, 100 x 130 ft. garage, etc., at 4th and Minnesota Sts. Estimated cost $350,000. Noted April 16.

Mo., Joplin—Bd. of Education, S. A. Harris, Secy., awarded contract for the construction of a 2 story junior high school, including manual training department, machine shop, etc. $168,709. Noted Mar. 26.

Mo., Kansas City — National Air Transport Co., 5936 South Cicero Ave., Chicago, Ill., is receiving bids for a 1 story, 120 x 120 ft. hangar, 1 story extension of machine and repair shop at Municipal airport here. Estimated cost $85,000 including equipment.

Mo., St. Louis—Federal Steam Specialties Co., 120 East Main St., Oklahoma City, Okla., awarded contract for a 2 story plant including 30 x 132 ft. pipe fitting and mechanical shop. Estimated cost $25,000.

N. J., Bloomfield—Bd. of Education, City Hall, will receive bids about May 15 for the construction of a 2 story grade school at Watchung and Broughton Aves. Estimated cost $300,000. Bartlett & March, Lefcourt Bldg., Newark, Archts.

N. J., Cresskill—Harris Bros. Co., will build a 2 story factory for the manufacture of builders and wholesale and retail building materials. Estimated cost $100,000. Private plans. Work will be done by separate contracts.

N. J., Jersey City—J. Goldenberg, 80 Woodland Ave., Englewood, is having preliminary plans prepared for the construction of a 15 story garage, here. $500,000. C. Shilowitz, 26 Journal Sq., Archt. Abandoned project for 4 story, 90 x 150 ft. garage and showrooms at Sip and Summit Aves. $150,000. Building permit denied.

N. J., Jersey City—Montgomery Cylinder & Grinding Co., 678 Montgomery St., will build a 1 story, 68 x 100 ft. auto engine remodeling plant at Tonnelle Ave. and Allen St. Estimated cost $40,000. O. L. Wutzdorff, 147 Summit Ave., Union City, Archt. Work will be done by separate contracts. Noted April 9.

N. J., Newark—S. Shaw & Co., 24 Commerce St., Archts., will receive bids about June 1 for the construction of a 2 story factory on Waverly Ave. for Unique Art Mfg. Co., 196 Waverly Ave. Estimated cost $100,000.

N. J., Passaic—Jersey City & Nutley Bus Co. (Kruger Bros.), 537 Franklin Ave., Nutley, will not construct 2 story garage here. $150,000. Project abandoned. Noted April 9.

N. J., Paterson — J. S. Royal, c/o Lee & Heuitt, 152 Market St., Archts., postponed construction of 2 story factory. $40,000. Indefinite when project will mature. Noted April 9.

N. Y., Brooklyn—Bd. of Education, 500 Park Ave., New York, is having sketches made for the construction of Franklin K. Lane high school, including woodworking and machine rooms, etc., at Jamaica Ave. and 76th St., here. Estimated cost $3,000,000. C. W. Martin, Flatbush Ave. Ext. and Concord St., Brooklyn, Archt.

N. Y., Buffalo—DuPont Cellophane Co., 2 Park Ave., New York, plans addition to plant here. Estimated cost $2,000,000.

N. Y., Buffalo—Granger & Co., 135 Scott St., awarded contract for a 3 story, 100 x 140 ft. warehouse at Bailey and Clinton Sts. Estimated cost $100,000. Noted April 23.

N. Y., Buffalo — Trico Products Corp., 817 Washington St., awarded contract for a 1 story, 95 x 185 ft. addition to factory for the manufacture of automobile accessories. Estimated cost $60,000.

N. Y., Edgemere—A. Mayes, Reid Lane, plans the construction of a 1 story, 100 x 100 ft. service garage. Estimated cost $40,000. Joseph Unger, 93 Main St., Flushing, Archt.

N. Y., Hollis—Police Dept., 240 Center St., New York, plans the construction of a 1 story, 50 x 200 ft. garage and service station at 222nd St. and 92nd Rd. here. Estimated cost $55,000. T. E. O'Brien, 240 Center St., New York, Archt.

N. Y., New York — Consolidated Gas Co., Irving Pl., awarded contract for the construction of a 3 story shop at 1160 York Ave. Estimated cost $350,000.

N. Y., Ridgeway (sta. White Plains) — Buckbee Construction Co., 162 East Post Rd., White Plains, will build a shop and office building here. Estimated cost to exceed $40,000. Work will be done by day labor. Maturity late in May.

N. Y., Ridgewood—Classen Sons Inc., 2368 Silver St., plans the construction of a 3 story, 75 x 109 ft. bakery and garage at Hughes and 60th Sts. Estimated cost $50,000. W. Fuhrer, c/o owner, Archt.

N. Y., Tonawanda—Buffalo Electric Furnace Corp., plans a 1 story addition to plant. Estimated cost $85,000.

O., Bedford — Lempco Products Co., plans addition to plant for the manufacture of axles and various motor parts. Estimated cost $250,000.

O., Youngstown — Truscon Steel Co., Dixie Terminal Bldg., Cincinnati, had plans made for a 1 story, 80 x 150 ft. plant here. Estimated cost $40,000, including equipment.

Okla., Oklahoma City — J. I. Case Co., Racine, Wis., manufacturers of agricultural machinery, will soon award contract for a 1 story, 50 x 204 ft. addition to plant here. Estimated cost $65,000.

Ore., Portland—S. Birkenwald Mfg. Co., 80 North 5th St., is having plans prepared for the construction of a 1 story, 100 x 100 ft. addition to factory for the manufacture of refrigerators and butchers' supplies at Pettygrove and 22nd Sts. Estimated cost $50,000. R. R. Clark, Railway Exchange Bldg., Archt.

Pa., Oil City — Empire Oil Works, W. J. Scott, Reno, is receiving bids for a 1 story, 30 x 40 and 40 x 120 ft. service station, garage and accessory building at State and Second Sts. Brenots & Hicks, Traymore Bldg., Oil City, Archts. Noted April 16.

Pa., Pittsburgh — F. Tinker & Sons, 5649 Berlin Way (rolling mill supplies), will soon award contract for the construction of a factory at 5600 Butler St. Estimated cost $40,000. R. M. Reutti, Whitfield Bldg., Archt.

Tenn., Memphis—Dixie Greyhound Lines and Smith Motor Coach Co., F. Smith, Pres., plan the construction of a bus terminal on Monroe St. between Second and Third Sts. Estimated cost $150,000. A. Hanker, Shrine Bldg., Archt. Maturity Aug. 1.

Tex., Beaumont — Coca Cola Bottling Co., plans the construction of a 2 story, 42 x 130 and 34 x 39 ft. bottling plant, including garage, etc. Estimated cost $100,000 including equipment. Pringle & Smith, 1012 Norris Bldg., Atlanta, Ga., Engrs.

Tex., Fort Worth—Texas & Pacific Ry. Co., Dallas, awarded contract for the construction of coach yard facilities, including seven buildings for cleaning, repairing and electrical charging and general upkeep of coaches. E. F. Mitchell, Dallas, Ch. Engr.

Ont., Kingston—Bd. of Education, awarded contract for the construction of a 3 story high and technical school. Estimated cost $300,000. Noted Mar. 26.

Ont., Kingston—Crescent Wire & Iron Wks. Ltd., Princess and Nelson Sts., awarded contract for a new plant.

Ont., Oakville—Heater of Canada Co., c/o W. B. Riddell, Sun Life Bldg., Hamilton, Archts., awarded contract for the construction of a 1 story, 50 x 281 ft. factory. Estimated cost $50,000.

Ont., Toronto—Norge Electric Refrigeration Ltd., c/o DeForest-Crosley Co. Ltd., 245 Carlaw Ave., plans the construction of a manufacturing plant.

Que., Montreal—G. W. Reed & Co. Ltd., 4107 Richelieu St., is having plans prepared for a foundry. T. Pringle & Sons Ltd., 410 St. Nicholas St., Archts.